A COMPETITIVE ANALYSIS OF FIELD SERVICE CAPABILITIES FOR CAD-CAM SYSTEMS

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ABSTRACT

This report contains an analysis of the field service capabilities of Applicon, Computervision, Auto-Trol and Calma as perceived by the respective users of these interactive graphics systems. The study also details the description and evaluation of Applicon, Computervision and M&S Computing field service programs as perceived by those vendors.

The report addresses issues for both hardware and software maintenance and presents recommendations for improvement of CALMA's field service program in each of these areas.

Y-CBD
July 1980

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JULY 1980

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I INTRODUCTION

I INTRODUCTION

- This report was prepared by INPUT as a custom study for Calma Interactive Graphic Systems, Sunnyvale (CA).

- The primary objective of the study was to determine the current field service capabilities of Calma's competition, consisting of:

  - Computervision.

  - Applicon.

  - Auto-Trol.

- Information for this study was obtained from several sources:

  - Interviews with:

    - Nine Applicon system users.

    - Eleven Calma system users.

    - Ten Auto-Trol system users.

    - Ten Computervision system users.

- Interviews with:

    - Applicon, Inc.

    - Computervision Corporation.

    - M&S Computing.

- Review of INPUT's files and previous studies on the subjects of both CAD/CAM and maintenance services.

- The profiles of users and vendors interviewed for the study are detailed in Appendix A-1.

II EXECUTIVE SUMMARY

II EXECUTIVE SUMMARY

A. CONCLUSIONS

1. OVERVIEW

- The 40 user respondents reported having a total of 63 CAD/CAM interactive graphic systems installed. However, none had more than one vendor's products in place.

- Final product selection was approved and/or recommended by the chief engineer or manager of the CAD/CAM section.

- Users interviewed represented both diverse industries (manufacturing, utilities, engineering, government) and applications (semiconductor, mechanical, piping design and mapping).

2. HARDWARE MAINTENANCE

- Mean time to repair is viewed by user respondents as the most important field maintenance characteristic, followed by mean time to respond.

- Mean time to respond, from a user's perspective, is not measured by working shifts (eight hours) per day, but by the total amount of time elapsed.

- The average minimum system uptime required by those interviewed was 93%, while the average actual uptime was 95%. The closeness of these reported averages presents the possibility that a vendor might be providing less than the minimum acceptable system uptime performance.

- Large, multiple-system users appear to establish more demanding minimum acceptable response times (e.g., one hour).

- Users agree that repairs must be completed within eight hours of the FE's arrival.

- Users reported that parts shortages were the source of their greatest dissatisfaction with hardware maintenance. Users believe that improved remote diagnostic capabilities will alleviate some of the parts availability problem.

  - Some users are approaching the OEM supplier for parts rather than the turnkey system vendor.

- Respondent users believe that all CAD/CAM vendors oversold their maintenance capabilities, and that none is fulfilling its commitments related to response time, repair time, preventive maintenance or software support.

- Despite users' dissatisfaction with the maintenance capabilities of vendors, none reported that its system was a "lemon." Most believed that the individual service people assigned to their accounts were doing their best.

- User respondents consider that field service personnel are holding up well, given the pressures of the part shortage problems under which they are operating.

- Users believe that inadequate field service results primarily from the burgeoning growth rate experienced by the CAD/CAM vendors and their inability to support the increasingly large installed base.

3. SOFTWARE SUPPORT

- The users interviewed reported considerable dissatisfaction with the software support supplied by all CAD/CAM vendors. No vendor received a top rating of five in this category by an respondent. Criticism of performance concentrated on:

  - The vendors' inability to meet schedules for new software releases.

  - The lack of support in implementing enhancements.

  - The unreliability of new software releases and specialized packages.

- Calma users voiced particular concern over software. Typical comments from respondents were:

  - "Latest software is bad and I refuse to use it . . ."

  - "It's hard to get software on time . . ."

  - "The problems with the software take too long to cure . . ."

- Respondents were also critical in their evaluation of software documentation. Computervision users were particularly vocal, with several stating that that company's documentation was virtually nonexistent.

- A few users have performed some cursory investigations into other vendors' software; however, there is no apparent tendency to abandon a current vendor's product. Despite support difficulties experienced by virtually all users, those interviewed remained loyal to their original vendors.

- Respondents usually developed their own operator training programs after initial instruction by the vendor during the product installation period.

- Although users had some difficulties with the definition of a "major software bug," there was general consensus that:
  - A vendor should isolate and provide a workaround solution within one day.
  - A product should not be released with a major bug.
  - In the case of a bug creating a minor inconvenience, they would wait up to a month for a repair.

- Software releases received in the form of tapes are acceptable to users, but improved documentation is desired.

- Respondents like user groups. Computervision seems to be the most responsive to users' needs and desires as reported by such regional groups.

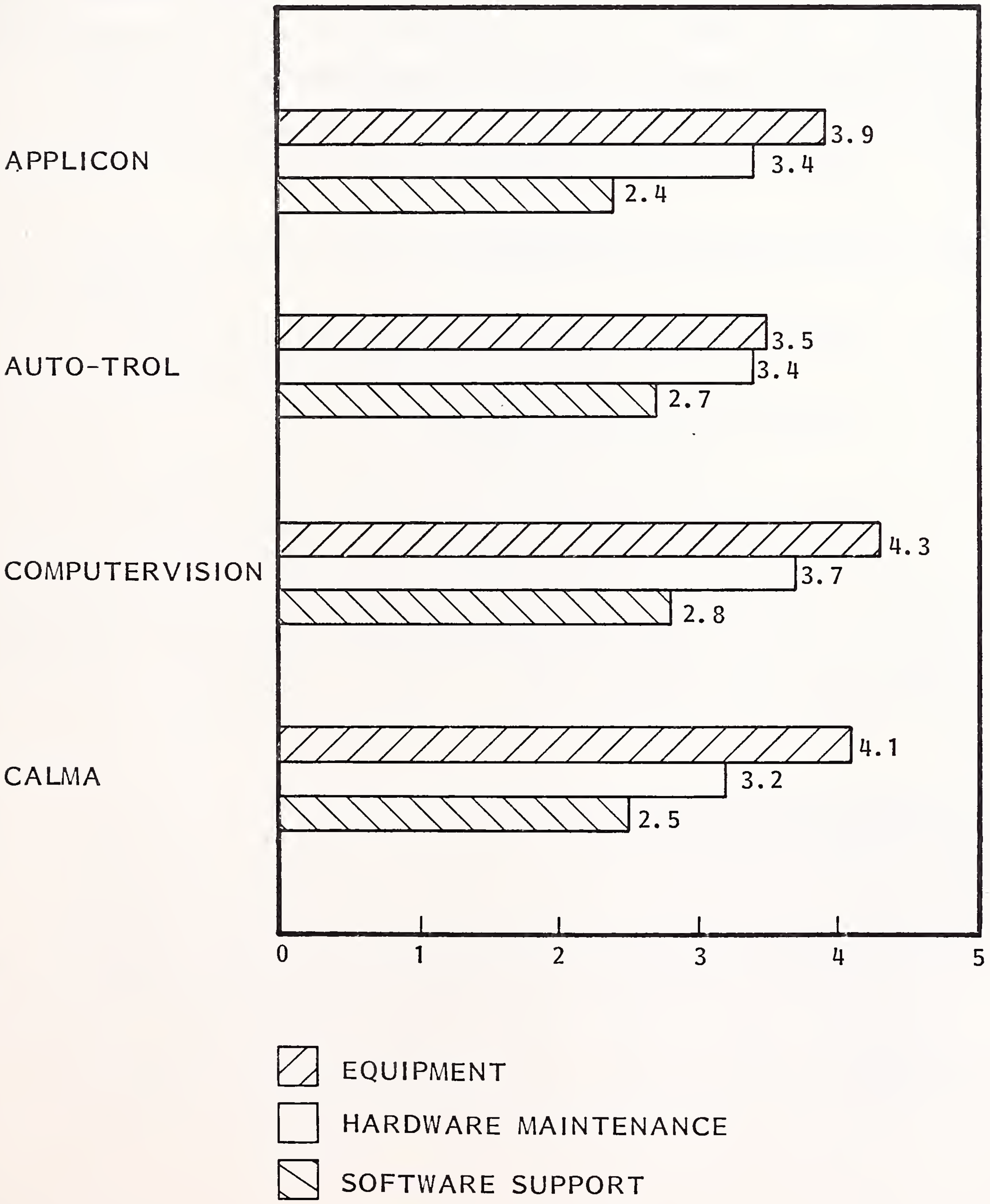
- Only 45% of the Calma users interviewed felt that they were receiving the level of support promised at the time of purchase. Items most frequently mentioned included:
  - Unacceptable turnaround time for hardware and software maintenance.
  - Lack of software support.

4. SUMMARY

- As shown in Exhibit II-1, user respondents have a high regard for the quality of equipment supplied by all vendors, giving an average rating of 3.5 to 4.3. Respondents demonstrated a near uniform response to vendors' hardware maintenance and software support, with rating spans of:
  - 3.2 to 3.7 for hardware maintenance.

EXHIBIT II-1

AVERAGE RATINGS BY RESPONDENT USERS
FOR EQUIPMENT, HARDWARE MAINTENANCE
AND SOFTWARE SUPPORT
(5: EXCELLENT; 4: VERY GOOD; 3: GOOD; 2: FAIR; 1: POOR)



  - 2.4 to 2.8 for software support.

- User respondents ranked Computervision highest for the added value factors of hardware maintenance and software support, while relegating Calma and Applicon to the low end of the scale.

- The users interviewed showed surprisingly strong loyalty to their selected CAD/CAM vendor, despite disappointments with the level of maintenance and support. When asked for their suggestions on improving the responsiveness of their vendor, the items most frequently mentioned were:

  - Improvement of parts availability.

  - Improvement of parts quality.

  - Reduction of turnaround time for software maintenance.

  - Continuity of personnel contact.

  - Improvement of FE's software knowledge and capabilities.

- Although users were not inclined to install their own systems, all but two of those interviewed would consider performing a diagnostic check prior to placing a service call.

B. RECOMMENDATIONS

- Recognize that, at the present, "being the best" in field maintenance among the vendors is insufficient. The best would be classified by their users as mediocre. There is great room for improvement of field service for all vendors.

  - Set standards of performance which are independent of the competition and superior in absolute rather than relative terms.

- Recognize that a Calma user may dispose of its presently installed system if it should elect to change vendors for future purchase of CAD/CAM systems.

- Establish appropriate definitions and means for calculating the mean time between failures.

- Determine why only 45% of those Calma users surveyed reported that they were being delivered the level of hardware and software maintenance promised at the time of equipment purchase.

- Develop methods for improving the attitudes of FEs towards the company by considering:

  - Installing an FE incentive program.

  - Developing additional FE training techniques.

  - Implementing a management escalation procedure.

  - For part shortages, applying site-down priorities over new product manufacture in order to ensure responsiveness to the user's requirements.

- Perform a job analysis of the serviceperson positions within the Calma maintenance function in order to review the skills and attitudes required for successful performance in that capacity. Identify those traits and attributes which characterize a high-performance serviceperson and structure selection and training procedures to maximize those traits and attributes.

- Consider the development of a remote diagnostic program, which would be of particular value to users at remote locations.

- Improve the part shortage situation by reviewing parts provisioning algorithms based upon vendor lead times, cost of stock-outs, weekly parts requirements, cost of carrying inventory, and anticipated part mortalities and engineering changes.

    - Capitalize upon being part of a larger corporation and having greater financial strengths than the competition by increasing the inventory of high-mortality parts.

    - Attempt to provide a greater standardization of parts or peripherals purchased on an OEM basis, and diminish the variety of equipment currently within the installed base, thereby decreasing the parts shortage or stock-out possibilities.

- If not yet available, consider installing a hotline service operating 24 hours a day for hardware and software support.

- Offer more comprehensive user training, and charge customers accordingly.

- Develop a schedule and program for installing all mandatory software and hardware changes within the installed base on a top-priority basis, and maintain configuration control thereafter.

- Categorize the elements contained within the full service coverage and assign costs and customer rates for each. Market this "menu" of services to customers and allow them to select a service contract that will most accurately reflect their needs. Vendors are presently selling contracts which are "full service" in name only. Providing this type of "cafeteria-style" service contract shifts a portion of the responsibility for maintenance to the users, at their option.

- Consider the following program, spearheaded by management, for developing a more positive identification with the user:

- Set up regional user meetings chaired by a corporate officer to explain the company's commitment to the CAD/CAM industry and its interest in improving the support of the installed base of equipment.

- Explain that a task force will be visiting selected users' sites to determine part mortality problems, software support needs, user training requirements and methods for establishing a remote diagnostic scheme.

- Establish a philosophy and plan for regional parts depots, on-site high mortality parts inventory programs and system support centers.

- Dispel users' perceptions that Calma is more remote since being acquired by United Telecom.

III USER ANALYSIS

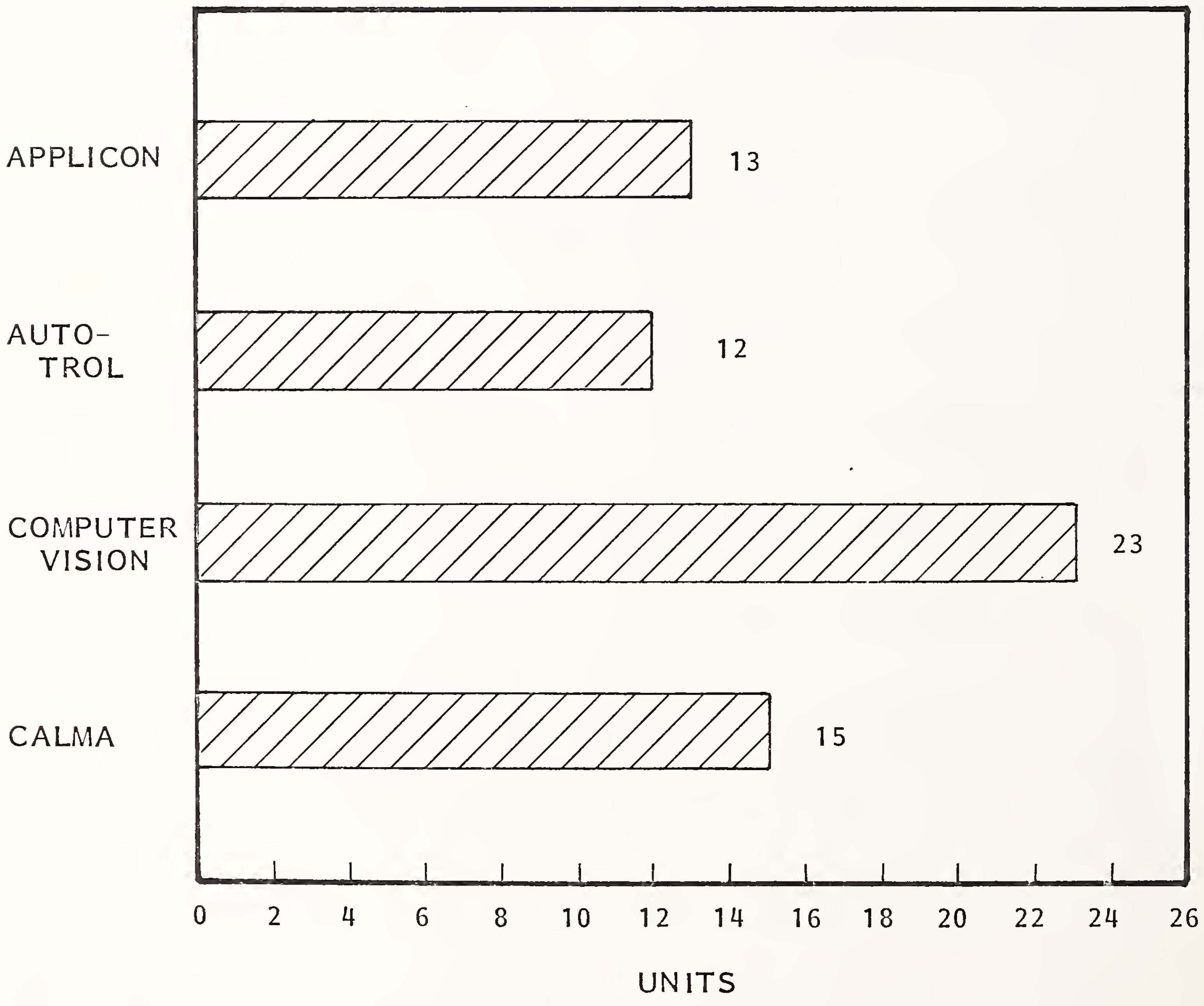
III USER ANALYSIS

A. SURVEY OF USERS

- Forty users of CAD/CAM interactive graphics systems were interviewed for this report. The sample was comprised of:
  - Ten Computervision users.
  - Ten Auto-Trol users.
  - Nine Applicon users.
  - Eleven Calma users.
- Although the majority of users had only one system installed at their site, several had multiple installations. The forty respondents had a total of 63 units in place with one site having nine, five-workstation systems installed.
  - The distribution of products by vendor is shown in Exhibit III-1.
- Respondents interviewed were usually managers or chief engineers of the CAD/CAM section within each company or division.

EXHIBIT III-1

TOTAL POPULATION OF VENDOR PRODUCTS AS REPORTED BY RESPONDENT USERS



- The sample represented a diverse mix of both industry sectors and applications.

  - Industry sectors: manufacturing, government, engineering and utilities.

  - Applications: semiconductor, mechanical, piping design and mapping.

- The annual revenues of the respondent users ranged from $12 million to in excess of $50 billion. Twenty-two of the 40 respondents reported annual corporate earnings in excess of $1 billion.

- All respondents were using the systems for CAD while five were additionally performing the CAM function.

- As shown in Exhibit III-2, users of Auto-Trol and Applicon systems were involved almost exclusively in the mechanical design applications while the users of Computervision and Calma systems were primarily operating in the area of semiconductor design.

B. ANALYSES OF SURVEY RESULTS

1. USERS' RATINGS OF FIELD MAINTENANCE CHARACTERISTICS

- Mean time to repair (MTTRp) was rated as the most important field maintenance characteristic, as shown in Exhibit III-3. It was followed closely by the respondents' ratings of mean time to respond (MTTRs). In the majority of cases, the respondents rated both MTTRs and MTTRp as being five on a one-to-five scale of importance.

EXHIBIT III-2

APPLICATIONS PERFORMED

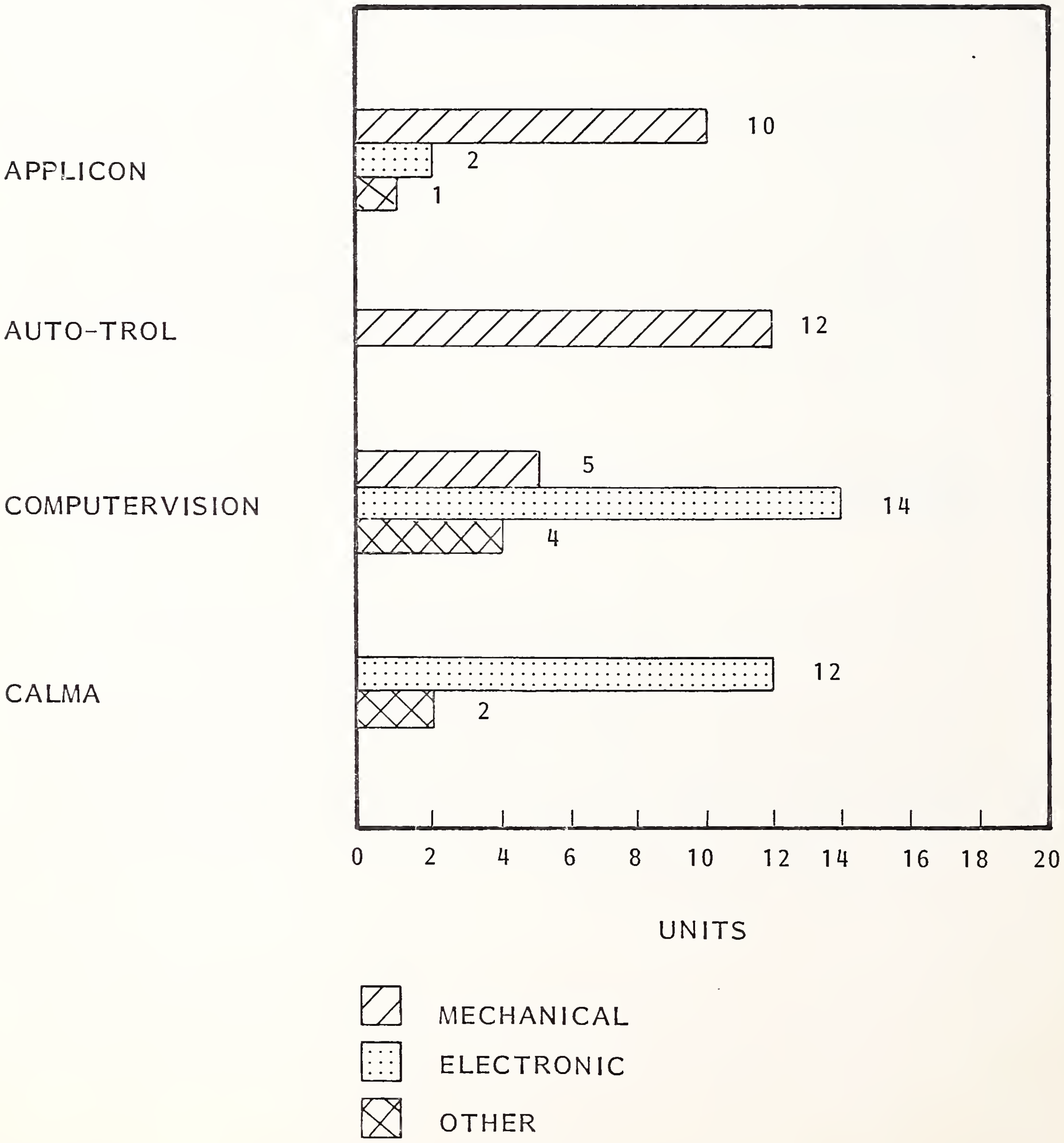
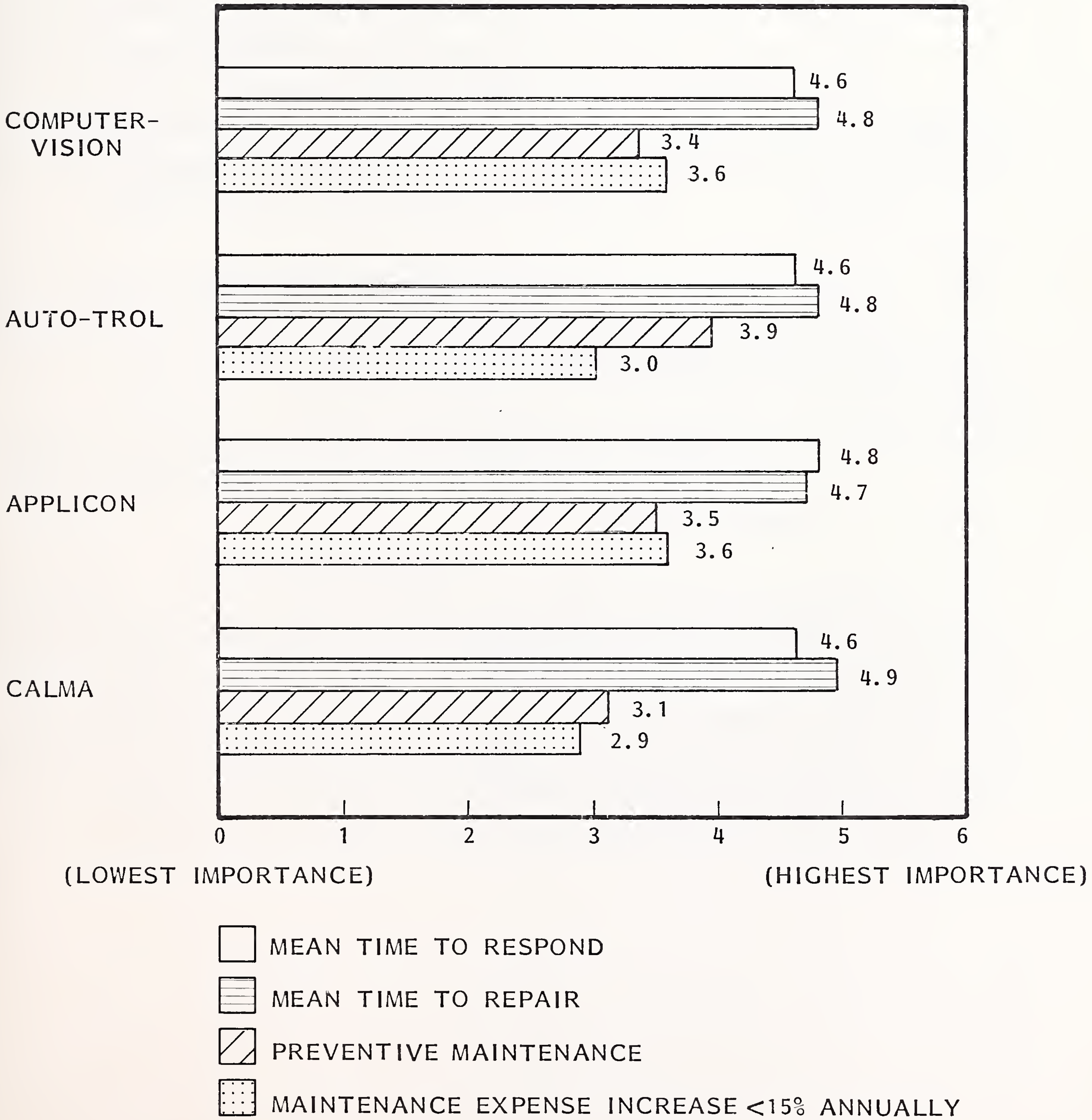


EXHIBIT III-3

IMPORTANCE OF FIELD MAINTENANCE CHARACTERISTICS AS REPORTED BY RESPONDENT USERS



- In those instances, the respondents were asked to rank MTTRs and MTTRp in terms of their relative importance. When forced to choose between the two field maintenance characteristics, the respondents selected MTTRp as the more important of the two in 75% of the cases.

- The distinction between MTTRp and MTTRs does not seem to be clearly defined in the minds of the respondents. The similar ratings of these two characteristics seem to be the result of an assumption on the part of the users that the service person will arrive on-site with the necessary tools and parts to repair the equipment. As the following results will indicate, this is not a valid assumption in many instances. Given a source of readily available parts, the arrival on-site of the service person should signal the beginning of the repair process.

- The respondents see the distinction between time to arrive on-site and time to repair after arrival on-site as being of less overall importance than the elapsed time between system failure and system repair.

    - In the opinion of one respondent, the most important field maintenance characteristic is the mean time to respond with the necessary parts to repair the system.

- Performing preventive maintenance (PM) and keeping maintenance expense at or below an average annual increase of 15% were rated as considerably less important characteristics of field maintenance than either MTTRp or MTTRs. Their relative low importance level reflects the respondents' serious convictions that the most important consideration in field maintenance is getting the equipment back up after a failure with a minimum delay.

2. MINIMUM ACCEPTABLE VERSUS ACTUAL PERFORMANCE LEVELS OF VENDOR FIELD SERVICE ORGANIZATIONS, AS PERCEIVED BY RESPONDENT USERS

a. Percentage Uptime

- The average actual uptime (95%) for users of systems for all four vendors surveyed exceeded the average minimum acceptable performance level for those users (93%).

- Ten users (25% of the sample) reported actual uptime less than what they considered minimally acceptable. Of these ten, one used Auto-Trol; two used Applicon; three, Computervision; and four, Calma.

b. Mean Time Between Failures

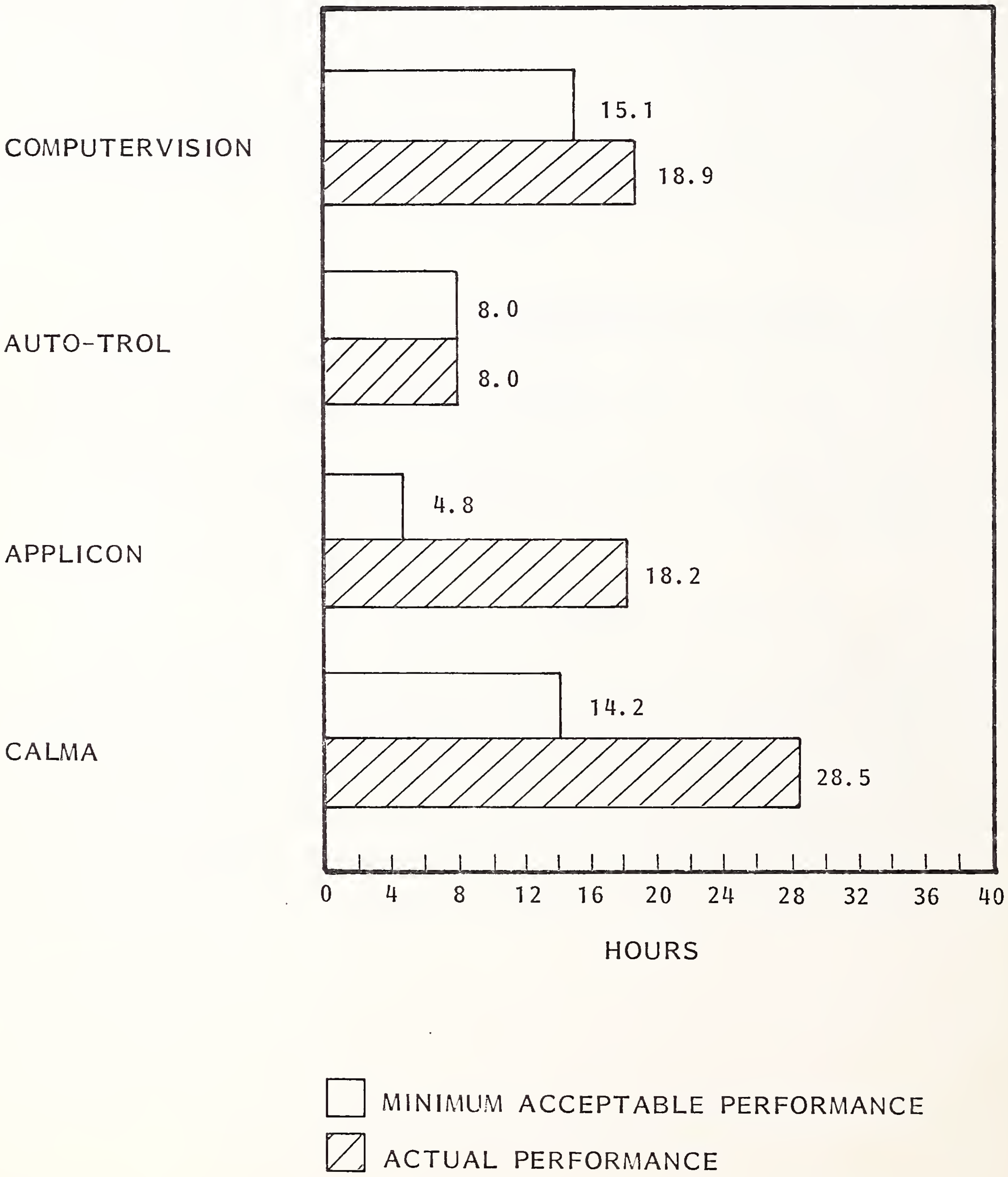
- User respondents were unable to provide consistent data to allow for a comparison of vendors for this factor. There is neither a standard definition nor a standard method of reporting failures of CAD/CAM systems among the survey respondents.

c. Mean Time To Respond

- The users of Auto-Trol and Applicon systems were considerably more demanding with regard to setting minimum acceptable response times for field service personnel than were users of Calma or Computervision, as shown in Exhibit III-4. The disparity is seen as being the result of users in divisions of very large corporations setting one-hour minimum response times which they felt were reasonable given the total corporate population of their vendor's products.

EXHIBIT III-4

MINIMUM ACCEPTABLE AND ACTUAL
MEAN TIME TO RESPOND
(AVERAGE HOURS REPORTED PER VENDOR)



- Respondents tend to state response time in terms of total elapsed time starting from the placement of the service call, rather than total elapsed working hours. Thus, a shop working one shift from 8 a.m. to 4 p.m. would report a response time of 24 hours if the service call was placed at 8 a.m. on Tuesday and the service person arrived at 8 a.m. Wednesday.

- Some respondents report receiving a phone call from the serviceperson or vendor within eight hours, but do not consider this a sufficient response to their problem. One respondent indicated that he felt the call was to give the illusion of response, when the only type of response he wanted was a serviceperson on-site fixing his equipment.

- Some typical comments:

  - "A phone call does very little to fix a broken disk drive."

  - "I guess they [Applicon] feel if they call you and let you know the repairman won't be able to get to you until tomorrow it will make me feel better - it doesn't."

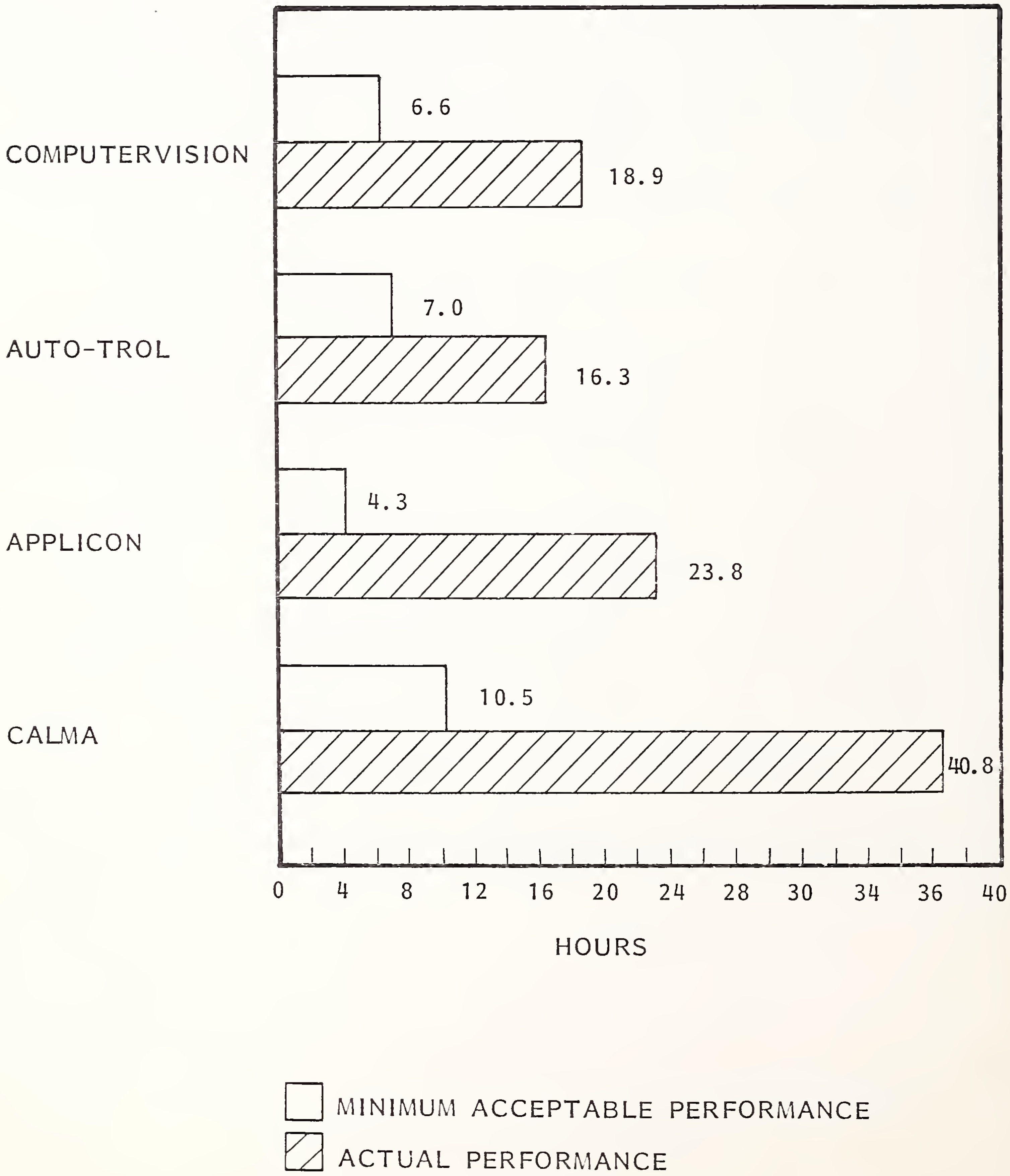
d. Mean Time To Repair

- As shown in Exhibit III-5, the average time to repair the system is considerably greater than users' expressed minimum acceptable levels for all vendors surveyed.

- Users universally agree that repair should be completed within eight hours after the arrival of the serviceperson.

EXHIBIT III-5

MINIMUM ACCEPTABLE AND ACTUAL MEAN TIME TO REPAIR (AVERAGE HOURS REPORTED PER VENDOR)



- The majority of the time reported as MTTRp is described as time spent awaiting the arrival of parts from the vendor's depot. Users are very dissatisfied with the parts availability problem and feel that there should be, at the minimum, a regional parts depot rather than one central location within the U.S. One respondent reports that Auto-Trol has promised the establishment of an East Coast parts depot by the end of July 1980.

- Users state their awareness of the problems associated with growth as rapid as the surveyed vendors have experienced, but indicate their patience is growing thin. They generally feel the time has come for a real solution to this problem.

  - Respondents feel that remote diagnostics hold some hope for a reduction in MTTRp if they are reliable enough to isolate the defective component and thus enable the service person to order the necessary part as soon as possible if that part is not in stock. Present diagnostics are not seen as being of great value in this regard due to their perceived complexity. Many users feel that they lack the necessary training to use the diagnostics effectively.

- As one respondent put it:

  - "I prefer to go to the OEM's first for my maintenance needs before calling Calma. Calma is growing too fast without paying proper attention to maintenance."

3. COMPARISONS BETWEEN VENDORS

- None of the users surveyed had more than one vendor's equipment installed at their site. Several comments were made regarding other vendors' systems primarily as they related to applications software. As reported later in this analysis, all vendor equipment was favorably rated and overall field maintenance is seen as being poor throughout the industry as the result of vendors' inability to increase their maintenance staff in proportion to their annual growth. Some typical comments:

  - "We checked out the software from Computervision, Applicon and Calma. For our needs, Calma is the best."

  - "I think Computervision's software is better than the competitors."

  - "We benchmarked three different systems before purchasing Computervision."

  - "Auto-Trol is the best for my application."

  - "Last Friday we looked at Computervision. Applicon better get on the ball in piping because Auto-Trol and Computervision are walking away with it."

  - "Each vendor has its good points in software but not enough in any one system to make us want to switch from Applicon."

  - "We checked Computervision, Auto-Trol, M&S, and Applicon. We rated Computervision number one and Auto-Trol number two. We went with Applicon because of the lower price."

  - "We checked out M&S, Auto-Trol, Computervision and Applicon. We rated Computervision number one, M&S number two and Applicon number three. We went with Applicon due to cost."

- "I've had experience with a number of the vendors and their response times are all bad."

- "Calma is not responsive but no one else would be any more responsive."

- "We looked at Computervision, Applicon, M&S and Auto-Trol. Auto-Trol is the best for my application."

- "We did a lot of research prior to selecting Calma."

- Since the respondent users don't rate one vendor's equipment as being superior to others, it is apparent that price and application software appropriateness are prime selling points for users.

4. VENDOR FOLLOW-UP

- Thirty-four of the 40 respondents reported that service personnel follow up with them upon completion of the repair. Users feel this should be the common procedure.

5. UNSCHEDULED SOFTWARE CHECKS

- Respondent users of Auto-Trol and Applicon systems view this practice as more desirable than do users of Computervision or Calma. Computervision and Calma users report the belief that the best check of software performance is actual system performance and perceive unscheduled calls as unnecessary.

- Users report that the "unnecessary-to-undesirable" scale does not represent a unidimensional construct. They feel that unscheduled software checks may be very desirable yet totally unnecessary. The desirability of such checks is seen as being dependent on their ability to reduce downtime without interrupting production during their performance.

6. IDEAL RESPONSE AND REPAIR TIMES

- As shown in Exhibit III-6, the ideal MTTRs and MTTRp reflects a situation in which the service person arrives on-site the same day as the call is placed and completes the repair within eight hours. This is only possible if an adequate supply of parts is available when the serviceperson arrives.

- Users do not feel that these times are unrealistic. In many cases the ideal time was stated to be the response and repair time agreed upon at the time of purchase.

- Respondents feel that the maintenance capabilities of all vendors were oversold to a great extent by the salespersons. While not stating that they were deliberately lied to about maintenance, they certainly imply that they were not told the whole truth.

- Some typical comments were:

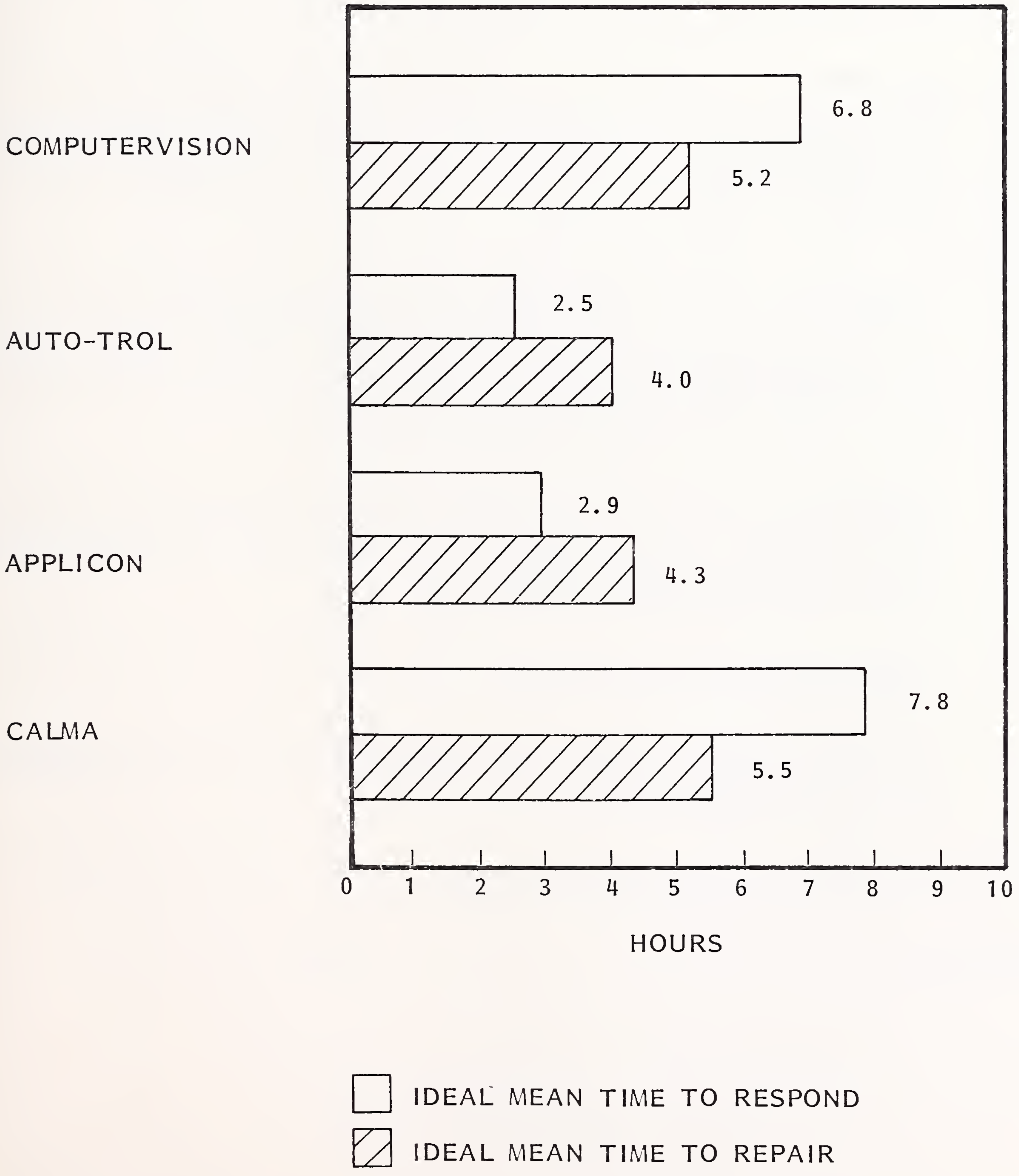
  - "They [Calma] promised us a 24-hour turnaround and haven't met it as yet."

  - "Computervision is not delivering the agreed upon response time for hardware maintenance."

- Users are universally opposed to spending any amount in addition to that which they are now paying for their ideal MTTRp and MTTRs. They feel the amount paid is sufficient to ensure this level of service. Respondents state that their present service rates were based on agreed upon levels of vendor performance and since they are now paying for a level of response they are not getting, they do not feel that any increase would be warranted until the levels of performance promised at the present rate are met.

EXHIBIT III-6

IDEAL MEAN TIME TO RESPOND AND MEAN TIME TO REPAIR (AVERAGE HOURS REPORTED PER VENDOR)



7. GENERAL EQUIPMENT AND MAINTENANCE EVALUATION

- As shown in Exhibit III-7, the users rated their equipment as being superior to the maintenance received on that equipment.

- The high ratings of all vendors' equipment indicates that users do not ascribe their service-related problems to the equipment design. Comments concerning the various vendors' equipment were quite favorable.

- Respondents are realistic in their attitude towards equipment failure. They are satisfied with the mean time between failures despite their inability to give consistent data as to its actual value. None of the respondent users felt they had been delivered a "lemon."

- The problems users are experiencing with response and repair times are not reflected in the overall rating of the maintenance function. Users' comments concerning this issue reflect the positive influence of the actions and skills of the individual service person with whom they deal.

- As one respondent put it, "The company would rate a two on a scale of one to five if it weren't for my serviceman - he's super. If you consider him in the overall rating, I'd give the company a four."

8. PREVENTIVE MAINTENANCE (PM)

- As shown in Exhibit III-8, users report dissatisfaction with the performance of PM for all surveyed vendors.

EXHIBIT III-7

QUALITATIVE RATING OF VENDOR EQUIPMENT AND MAINTENANCE (AVERAGE RATING PER VENDOR)

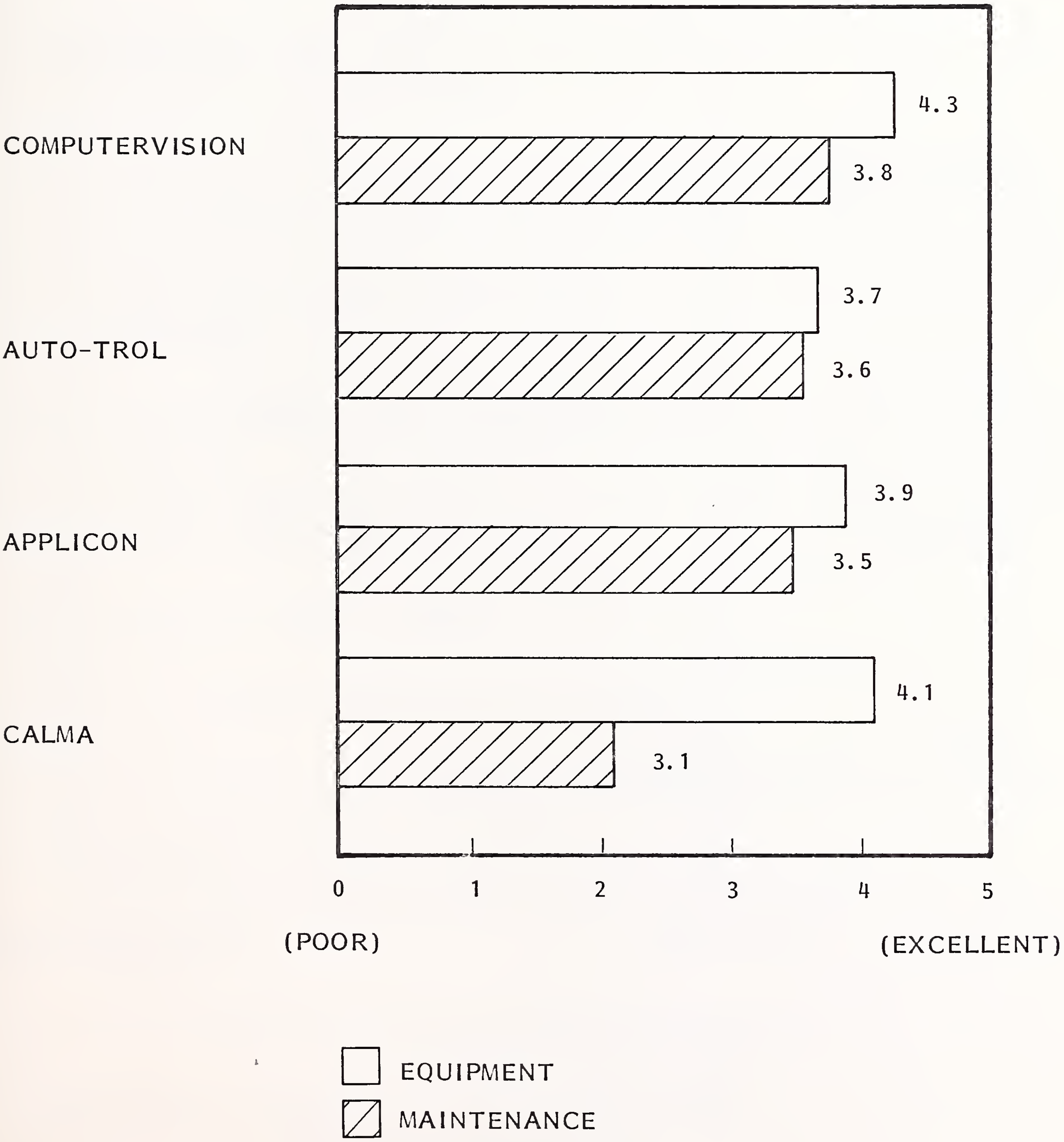
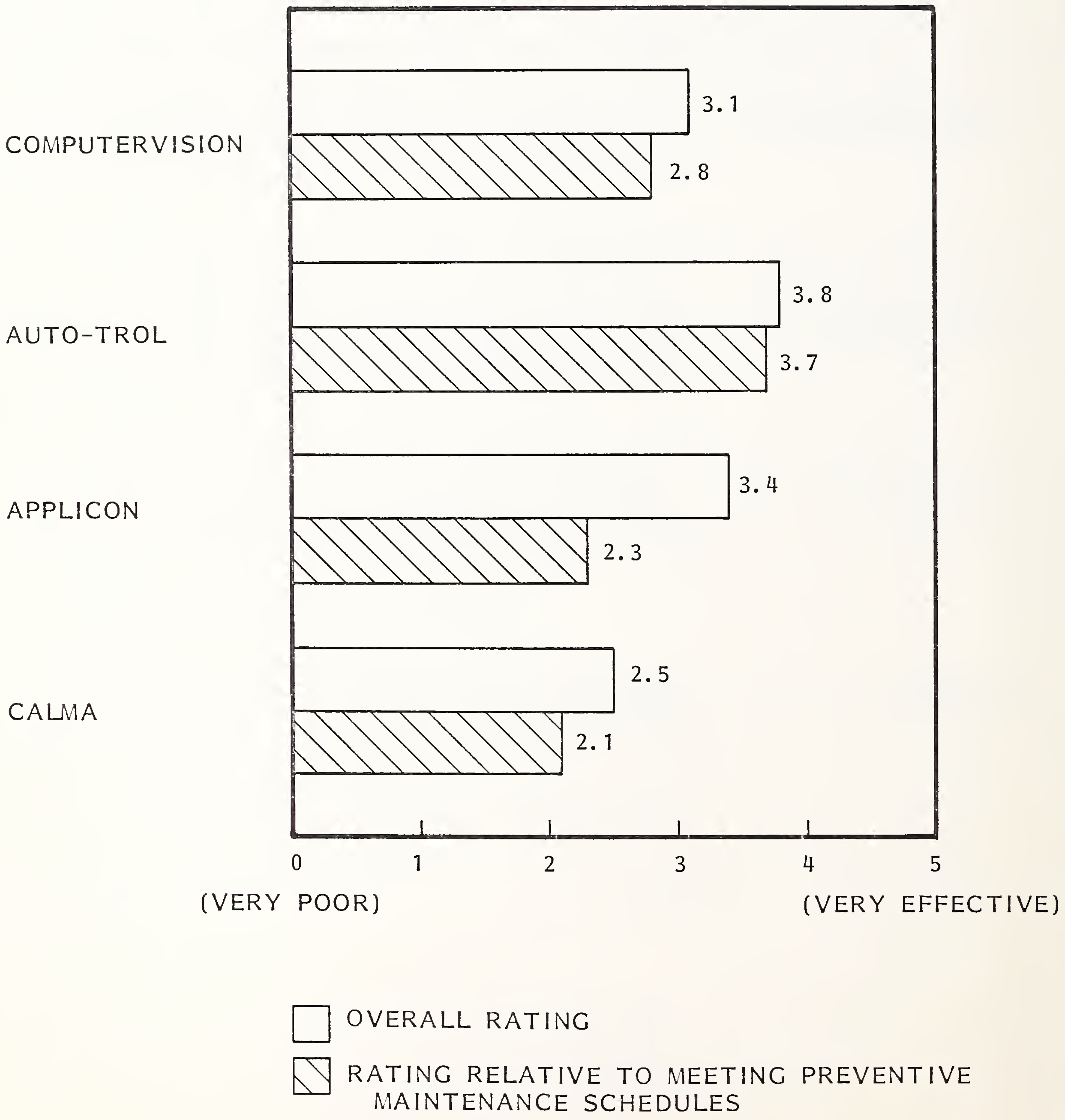


EXHIBIT III-8

USERS' EVALUATION OF PREVENTIVE MAINTENANCE



  - Respondent users of Auto-Trol systems report a higher level of satisfaction with PM but also report that, in many cases, the PM is not performed due to the user's production requirement prohibiting its release of the system for PM. Thus, users cannot place the blame for lack of PM on the vendors' shoulders, and the rating should be interpreted as an indication not of satisfaction but of an acceptance of responsibility for the failure to perform PM on schedule.

- Respondents report difficulty getting Computervision or Calma to even provide them with a PM schedule.

- Users see PM as a possible way to avoid system failure much the same way that changing the oil in their cars helps forestall any major engine failure. Since the respondents are not satisfied with the amount of time it takes to get a system back into operation, they feel the least they can do is ensure that the PM function is attended to.

- As one respondent put it: "I don't understand Computervision's failure to perform PM. You can't use the parts availability excuse there. It gives the impression that their equipment is somewhat unreliable if they're too shorthanded to do the minor maintenance."

- Some typical responses include:

  - "Applicon is pretty soft on PM schedules."

  - "Computervision will not set a PM schedule despite the fact that our service contract calls for it."

  - "Since the new repairman started in April, we've seen no PM." (Calma user)

  - "Auto-Trol is a little lax in meeting PM schedules."

9. EVALUATION OF FIELD PERSONNEL

- As shown in Exhibit III-9, field service personnel are rated as being "good" to "very good" on all evaluation criteria. There is no trend for the service personnel of any particular vendor to be rated better than the service personnel of any other vendor.

- With few exceptions, the attitude of the servicepersons is rated as good. They are seen as holding up rather well given the lack of support they receive from their employer. It is clear that if there were to be a villain to blame for the maintenance woes of the users, it would not be the serviceperson.

- The proficiency level of the service staff is seen by the respondents as being a function of length of time on the job. Users feel that while many of the service people could be better trained, they learn rapidly and, after a sufficient amount of experience with the equipment, become very proficient.

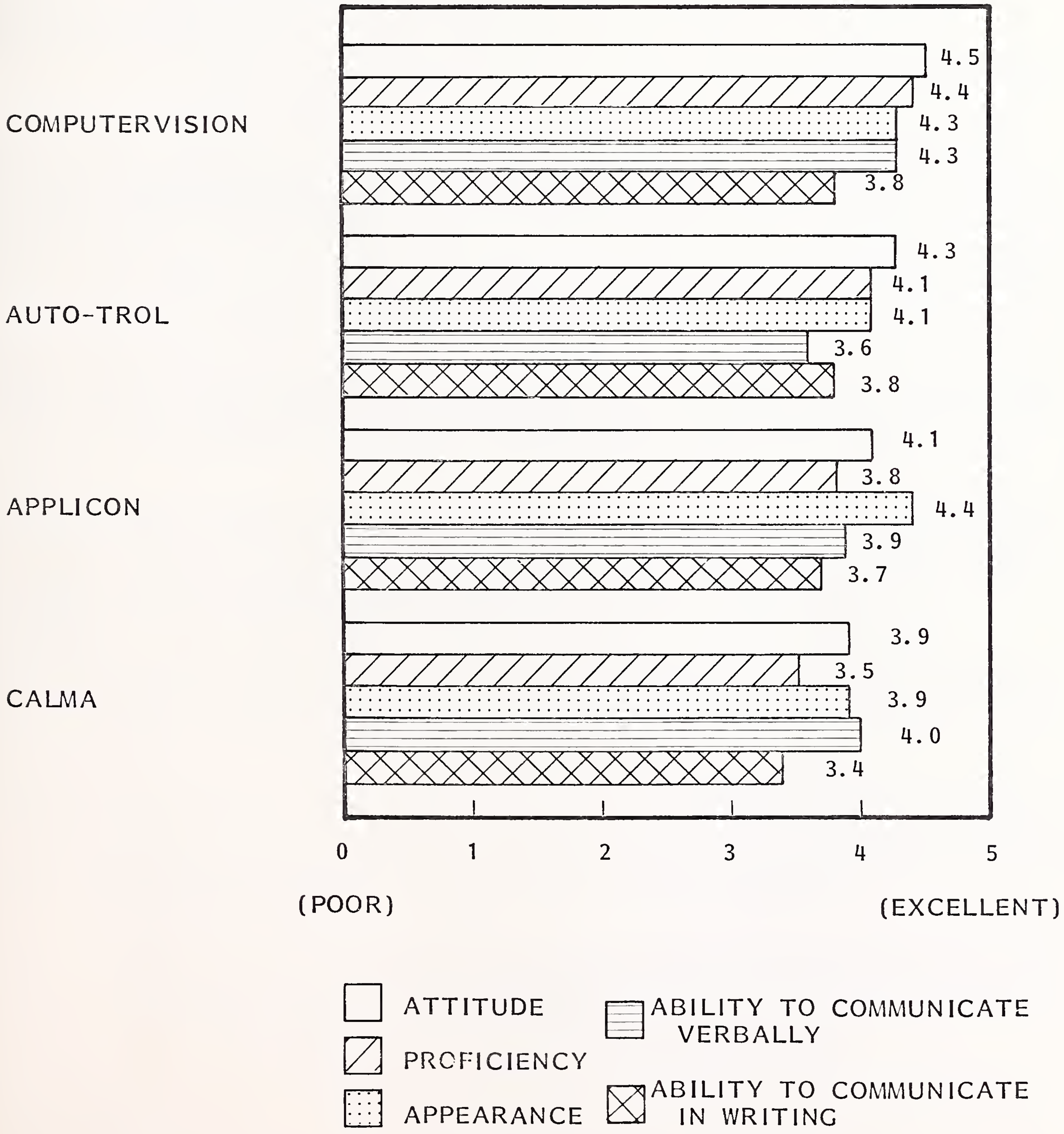
- Users feel that the rapid growth experienced by the surveyed vendors has a negative effect on the skill levels of the service people working on their systems. A common complaint is that as soon as servicepeople become proficient, they are either promoted or transferred. Users are then left to endure the on-the-job training period of the replacement.

- The respondents rated the appearance of the service personnel as good simply because they were totally unconcerned about whether they wore a shirt and tie, overalls, or (as one respondent put it) came in stark naked. As long as their system was repaired, the appearance of the serviceperson was irrelevant. A suit and tie may present a more professional image, but an average response time in excess of the user's minimum acceptable level apparently negates any positive effect attributed to appearance.

- Only one user reported having had a female serviceperson (she was rated as the equal to a male) and thus no conclusions can be drawn concerning the relative effectiveness of females as compared to their male counterparts.

EXHIBIT III-9

USERS' EVALUATION OF SERVICE PERSONNEL
(AVERAGE RATING PER CATEGORY PER VENDOR)



- The respondents also rated the service personnel of all surveyed vendors to be above average in their ability to communicate both verbally and in writing.

10. RELATIONSHIP OF USERS TO SERVICE PERSONNEL

- The respondent users' attitudes towards the service personnel was noticeably different from the general dissatisfaction expressed towards the maintenance function of the vendors surveyed. Users see the vendors as becoming increasingly remote. Their only direct contact with the vendor is through the serviceperson.

- While there were favorable remarks concerning the vendors' equipment the praise directed towards many individual servicepersons was quite unrestrained. Users are very appreciative of the "extra effort" of their individual servicepersons.

- While respondents also report what they feel to be incompetent service personnel, they feel it's much easier to get rid of a bad one than it is to replace an excellent one.

- The high value placed on certain service personnel by users raises the possibility of the larger users competing for the services of the more proficient service persons should they decide that their operation warrants a full-time, in-house maintenance position. This is the manner in which one respondent user solved his problem with software support from Calma. He hired a person from Calma.

- Some typical comments:

  - "FEs are fantastic but they can't do anything without parts."

  - "Our present serviceman is fantastic."

  - "Our repairman is very dedicated; he's super."

- "We have a real good serviceman right now."

- "Our new serviceman is excellent."

- "My man makes unscheduled service calls to check on my system and I really appreciate it."

- "The longer the service people are on the job, the better they get."

- "They have good service people. They are spread too thin, but the total effort is good; they are very cooperative."

II. USERS' SATISFACTION WITH SOFTWARE SUPPORT

- As shown in Exhibit III-10, there is a very broad dissatisfaction with the software support provided by all interactive graphics systems vendors.

- On a rating scale of one to five, no vendor received a rating of five (which would indicate a high degree of satisfaction).

- Typical responses center around the inability of all surveyed vendors to meet schedules for new software releases as well as the user-perceived lack of support in implementing upgrades.

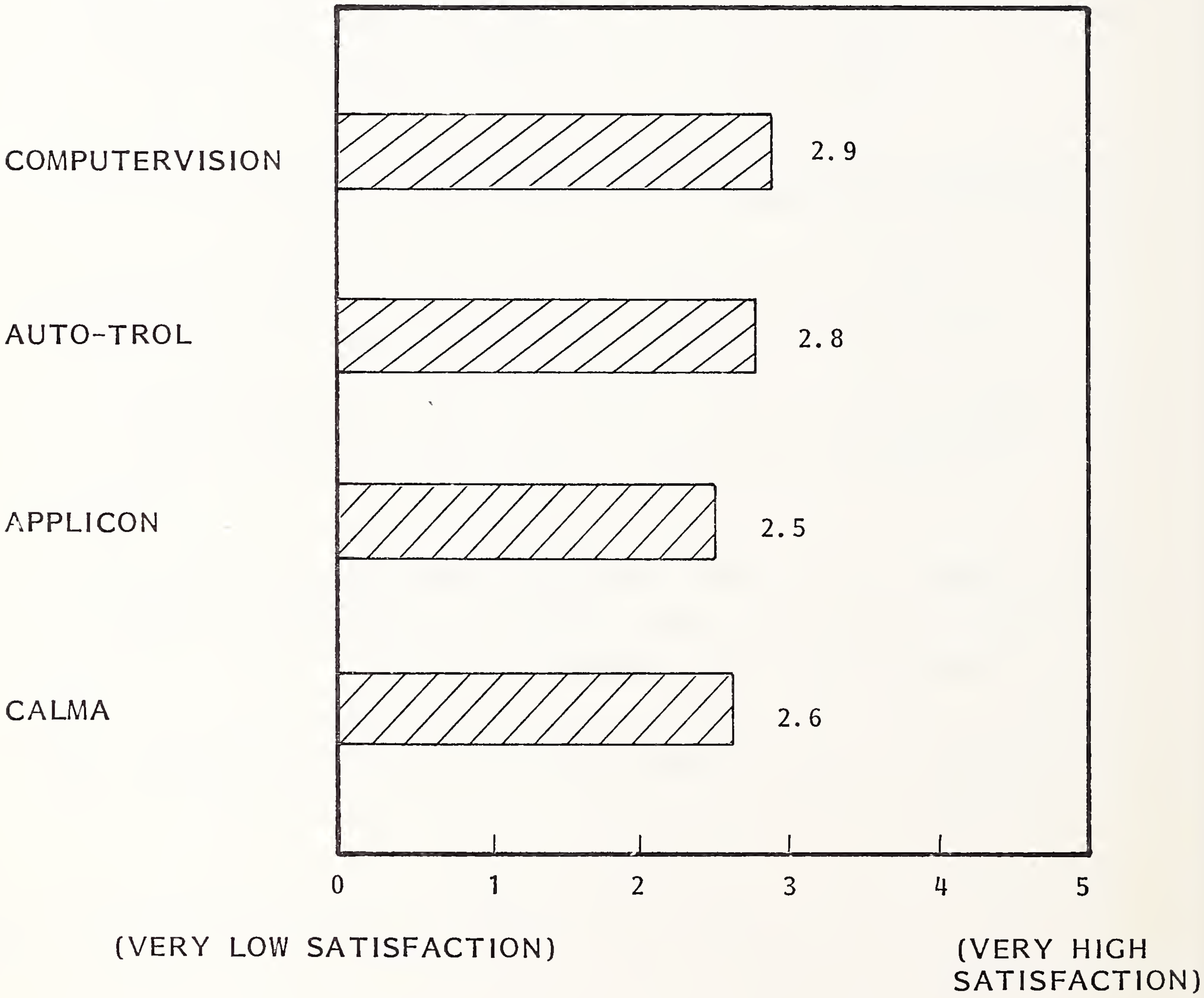
- Software support problems are seen by users as being the direct result of the rapid growth experienced by the vendors.

- The majority of respondents feel that the basic software is very reliable but that the specialized packages and new releases are at less than acceptable levels of reliability.

- Calma users in particular are dissatisfied with what they feel to be unacceptable software support. Some comments were:

EXHIBIT III-10

DEGREE OF SATISFACTION WITH SOFTWARE SUPPORT OFFERED BY VENDORS, AS REPORTED BY RESPONDENTS



- "The latest software is bad; I refuse to use it. I've been supplied with four updates to my original software and all have been unacceptable. I've gone back to the original."

- "It is hard to get software on time, and with special requests you don't get all of what you order. When first received, they are not reliable or correct."

- "The problems with software take too long to cure. The accounting module we got never worked. We then had a delay of over six months to get it working."

- Respondent users for all vendors surveyed vary considerably in their evaluation of the software documentation provided to them by their respective vendors. Computervision users are the least satisfied with the documentation. Several respondents describe Computervision's documentation as being effectively nonexistent.

- Auto-Trol users describe the documentation as being "adequate" while Applicon users characterize the documentation as "weak but improving." Calma users see the documentation as being weak and in several instances somewhat unclear for new releases and upgrades.

12. CHECKING OTHER VENDORS' SOFTWARE

- The majority of the user respondents have not checked other vendors' software or have not checked since the initial decision to purchase their present system.

- The following are selected comments regarding comparisons of vendors' software for respondents who have checked competitive software.

  - "Last Friday we looked at Computervision. Applicon better get on the ball in piping because Auto-Trol and Computervision are walking away with it."

- "I think Computervision's software is better than the competitors'."

- "We checked out the software from Computervision and Applicon and for our needs, Calma is the best." (Electronics manufacturer)

- "For pure graphics, Auto-Trol is the best."

13. EVALUATION OF USER TRAINING

- For the most part, the respondents have used the vendor-provided training during the initial installation period but have since developed their own training programs in an effort to cover the informational needs of their specific applications better. Many of the evaluations are applicable to situations which existed three to four years ago, which prevents any meaningful comparisons of the training provided by the surveyed vendors.

- Users reported that the development of in-house training was the result of the vendor having an incomplete knowledge of their application requirements. Respondents feel that after using the system they are better qualified to determine what should be included in the training and what is unnecessary.

14. USERS' PERCEIVED ACCEPTABLE AND ACTUAL TIME TO REPAIR A MAJOR SOFTWARE BUG

- Respondents had a great deal of difficulty in determining what constitutes a "major" software bug. They state that the identical bug may be both major and minor relative to the production needs extant at the time of discovery. Additionally, to some the term "fix" means returning to a previous revision, while to others it means actually eliminating the bug.

- Users believe that the vendor should be able to isolate the bug and work around it within one day.

- Respondents feel that software isn't or shouldn't be released if it contains a "major" bug.

- Users are willing to wait for a period, not to exceed one month, if the bug is merely inconvenient. If the bug disrupts production, the general attitude is that it should be fixed immediately (within three days).

- The standard format in which all users receive a software release is a tape, with varying levels of user-perceived documentation adequacy. All respondents are satisfied with the use of tape dumps for software released but would like to receive better documentation.

15. SOFTWARE ENHANCEMENTS

- Respondents report the average number of software releases per vendor per year as follows:

  - Computervision - 2.

  - Auto-Trol - 2.

  - Calma - 3.

  - Applicon - 4.

- Respondent users of Computervision, Auto-Trol and Applicon systems indicate that requests for software enhancements are generally submitted to the vendors through regional user group organizations. The typical procedure is for each group member to submit a request for software enhancements and the total list of all requests is reduced to the top ten on the basis of a group vote. This list is then submitted to the particular vendors.

- Computervision users rate their vendor as being very responsive to the requests submitted by the user group, but characterize that response as being somewhat slow. Users of Auto-Trol and Applicon systems consider their vendors to be less responsive to the suggestions of the user group.

- Participation in these user group organizations reflects the user's evaluation that vendors' responsiveness is in direct proportion to the amount of pressure exerted upon them to be responsive.

- Particular users feel that if the user group in which they are a member is dominated by organizations having different software needs than their own, their impact in that organization is severely limited. Thus a user with a mechanical application would be unlikely to have its software needs voted into the top ten in an organization dominated by users with semiconductor design applications.

16. VENDORS' DELIVERY OF CONTRACTUALLY COMMITTED LEVELS OF HARDWARE AND SOFTWARE MAINTENANCE OR SERVICE

- The following percentages of respondent users felt that, on balance, their vendor was delivering the level of hardware and software maintenance agreed to at the time of purchase:

  - 90% of Applicon users.

  - 80% of Auto-Trol users.

  - 60% of Computervision users.

  - 45% of Calma users.

- Computervision users who feel that they are not receiving the agreed-upon level of service most frequently mention the unacceptable turnaround time for both hardware and software maintenance as the reason for this belief.

- Dissatisfied Calma users most frequently mention a promised 24-hour response time which they feel has not been met to their satisfaction.

- The respondents feel that the vendors surveyed are fairly responsive in answering simple hardware and software questions they might have. They report, however, that the responsiveness is declining in the area of software due to their perceived lack of personnel continuity within the vendors' software organizations.

17. USERS' SUGGESTIONS FOR VENDORS' IMPROVEMENTS

- As shown in Exhibit III-11, improved parts availability was by far the most frequently mentioned improvement desired by the respondents.

- The second most frequently mentioned improvement concerned the quality of the spare parts. Computervision and Auto-Trol users report receiving parts which have more problems than the part they are meant to replace. This causes an additional delay in the repair of the equipment in excess of the already unacceptable levels for MTTRp.

- As shown in Exhibit III-12, the most frequently mentioned improvement a vendor could provide in either software maintenance or service was a reduction in the turnaround time for software maintenance.

- Several respondents expressed a desire for more continuity of personnel for the vendor software function. They stated that they are often unable to contact the same person twice and thus must continually start from scratch with a new person.

- The second most frequently mentioned improvement centered on the increase in user-vendor interaction/communication within the area of software maintenance as well as software development.

EXHIBIT III-11

SUMMARY OF THE MOST IMPORTANT IMPROVEMENTS A VENDOR COULD PROVIDE FOR HARDWARE

COMPUTERVISION

- Parts Availability - 6 mentions
- Better Quality Assurance for Parts - 1 mention
- Improved Inter-System Communications - 1 mention
- Permission to Use Other Than Computervision Peripherals - 1 mention
- Improved FE Training - 1 mention
- Improved Response Time - 1 mention

AUTO-TROL

- Parts Availability - 5 mentions
- Better Quality Assurance for Parts - 3 mentions
- Improved FE Training - 1 mentions
- Improved Diagnostics - 1 mentions

APPLICON

- Parts Availability - 3 mentions
- Improved Diagnostics - 1 mentions
- Improved Response Time - 1 mention
- Increased User/Vendor Communication - 1 mention
- Regional Specialists - 1 mention
- Human-Factored Equipment - 1 mention
- Improved Management/Service Coordination - 1 mention

CALMA

- Parts Availability - 4 mentions
- 24-Hour Service Hotline - 2 mentions
- Improved Response Time - 2 mentions
- Scheduled PM - 1 mention
- Increased Software Orientation for FE - 1 mention
- User Maintenance Training Program - 1 mention

EXHIBIT III-12

SUMMARY OF THE MOST IMPORTANT IMPROVEMENTS A VENDOR COULD PROVIDE FOR SOFTWARE

COMPUTERVISION

- Improved Turnaround Time - 5 mentions
- Increased User/Vendor Interaction - 2 mentions
- Software Speed - 1 mention
- Improved Documentation - 1 mention

AUTO-TROL

- 24-Hour Software Hotline - 2 mentions
- Improved Documentation - 2 mentions
- Improved Software Problem Definitions - 1 mention
- Improved Software Diagnostics - 1 mention
- Improved Software Development Control - 1 mention
- Improved Performance on Software Delivery Schedules - 1 mention

APPLICON

- Improved Turnaround Time - 3 mentions
- Ongoing User/Vendor Communications - 1 mention
- Improved Availability Of Knowledgeable Software People - 1 mention
- Improved Specialized Applications - 1 mention
- Improved Software Reliability - 1 mention
- Demo Program for Software - 1 mention

CALMA

- Improved Turnaround Time - 2 mentions
- Improved User/Vendor Communications - 2 mentions
- 24-Hour Software Hotline - 2 mentions
- Improved Software Documentation - 2 mentions
- Data Link Between User and Vendor - 1 mention
- Improved Color MIS - 1 mention

18. USER INVOLVEMENT IN EQUIPMENT MAINTENANCE

- The majority of all respondent users are opposed to self-installation of equipment and would not consider it as an option.

- Only two users expressed a reluctance to consider running diagnostics prior to placing a service call. They see diagnostics as a promising method to reduce repair time by isolating the problem and providing the servicepersons with information regarding the necessary parts prior to their arrival. Users feel that present diagnostics cannot be of more than minimal use in this regard due to the perceived complexity.

- The majority of all users would also consider performing minor maintenance on their equipment as long as there would be no impact on the equipment warranty as the result of their efforts. Ten out of the eleven Calma users surveyed are presently performing some maintenance on their equipment.

- Most respondents would not consider delivering equipment to a vendor maintenance depot, citing unnacceptable turnaround time as the prime reason.

- Those respondents indicating that they would consider depot level maintenance stated that they would require a substantial, as yet undetermined, reduction in the cost of their service before seriously considering such an option.

IV SURVEY OF INTERACTIVE GRAPHICS VENDORS

IV SURVEY OF INTERACTIVE GRAPHICS VENDORS

A. APPROACH

- The analyses and conclusions that follow were derived primarily from data collected during vendor interviews with:

    - Computervision Corporation.

    - Applicon Inc.

    - M&S Computing.

- The interviews were conducted by telephone and averaged one-half hour in length.

- Open-ended questions which yielded qualitative responses have been quoted or paraphrased.

B. ANALYSIS OF RESULTS FOR COMPUTERVISION CORPORATION

1. INTERVIEWEE PROFILE

- The individual interviewed was the Vice President of Services. He reports directly to the President of the company and expects this practice to continue throughout 1981-82.

- The functions reporting to this individual are:

  - Field maintenance.

  - Customer education.

2. NUMBER OF MAINTENANCE DEPOTS

- The subject refused to comment on this question.

3. NUMBER OF FIELD ENGINEERING LOCATIONS

- Subject reports Computervision having 60-70 field engineering locations of which 20-24 are regional offices or authorized stocking points.

- Subject states that the number of field engineering locations is expanding at an annual rate of 100%.

4. MAINTENANCE PERSONNEL

- The maintenance function of Computervision is reported as having a total of 520 personnel distributed as follows:

  - Field engineers: 200.

- Applications engineers: 100.

- Field management: 50.

- Administrative: 170.

5. SYSTEM SUPPORT CENTERS

- The subject reports that there are presently three systems support centers, one each in:

  - United States.

  - Europe.

  - Japan.

- The respondent prefers not to comment on future plans regarding systems support centers beyond stating that it is Computervision's desire to have one systems support center for each geographic area at the present time.

6. VENDOR'S RATING OF SERVICE PERSONNEL RELATIVE TO COMPETITORS

- The respondent declines any comment.

7. FIELD ENGINEERING TRAINING PROGRAM

- Subject declined to comment beyond stating that Computervision has formal training programs for field engineers for both hardware and software.

- The respondent feels it is important to state that they have an ongoing customer training program which was presented to 4,500 persons during the last year.

8. PERSONNEL TURNOVER

- Subject declined to state either the total number of new hires or the number of separations for field engineering personnel for the last year.

- The respondent does report, however, that the field engineering staff increased its total number by 113% during 1979.

9. FIELD ENGINEERING INCENTIVE PROGRAMS

- Computervision is reported as not having an incentive program for field engineers.

10. PERCENTAGE OF TIME INSTALLING ENGINEERING CHANGE NOTICES

- Subject declined to respond.

11. VENDOR'S PERCEPTION OF THE IMPORTANCE OF FIELD MAINTENANCE CHARACTERISTICS TO USERS

- On a one-to-five scale of importance (with one indicating lowest importance and five indicating highest importance), the respondent rated the following characteristics as to their relative importance to Computervision users.

  - Mean time to respond: 4.
  - Mean time to repair: 2.
  - Performance of PM: 3.
  - Keeping maintenance expense below annual 15% increase: 2.
  - Applications support: 5.

- The respondent states performance targets for the following field maintenance characteristics.

    - Mean time to respond: 4 hours (feels they are meeting this).

    - Mean time to repair: 2.75 hours.

- As shown in Exhibit IV-1, the vendor's rating of the maintenance characteristics:

    - Slightly underestimates the users' rating of response time (average user rating 4.6, vendor rating 4.0).

    - Greatly underestimates users' rating of repair time (average user rating 4.8, vendor rating 2.0).

    - Closely approximates users' rating of PM function (average user rating 3.2, vendor rating 3.0).

    - Underestimates users' rating of importance of keeping annual maintenance at or below 15% annually (average user rating 3.4, vendor rating 2.0).

- While the results of the user survey should not be assumed to reflect the ratings of the totality of Computervision users, it does indicate that for those users surveyed, the vendor does not have an accurate view of the relative importance they attach to the field maintenance characteristics.

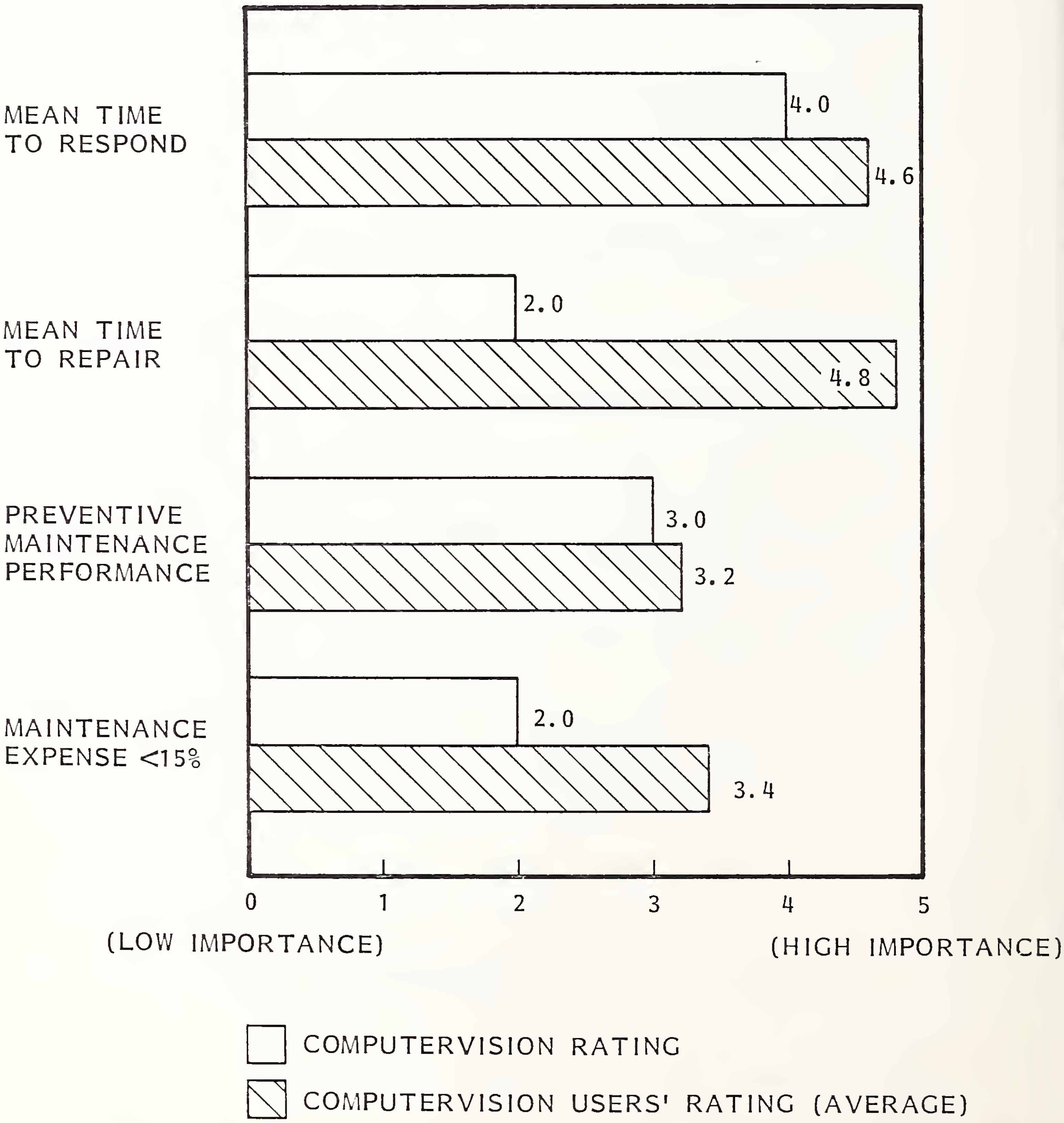
12. ACTUAL PERFORMANCE LEVELS AS REPORTED BY VENDOR

- The respondent states that the following performance levels are representative of the service being received by Computervision users.

    - Uptime: 95-99%.

EXHIBIT IV-1

COMPARISON OF COMPUTERVISION AND COMPUTERVISION USERS' RATINGS OF THE IMPORTANCE OF FIELD MAINTENANCE CHARACTERISTICS



  - Mean time between failures: states unreliability of data due to problem of removing those calls which were found to be operator error.

  - Mean time to repair: 2.75 hours (states this will vary according to area).

  - Mean time to respond: 4 hours (states they are "beating" this).

- Actual performance levels as reported by users were:

  - Uptime: 94%.

  - Mean time between failures: none (unreliable data).

  - Mean time to repair: 18.9 hours.

  - Mean time to respond: 24 hours.

13. QUALITATIVE EVALUATION OF MAINTENANCE OPERATION

- On a one-to-five scale (with one indicating poor and five indicating excellent), the respondent rated Computervision's maintenance operation as follows:

  - Personnel turnover: 3.

  - Mean time to respond: 4.

  - Mean time to repair: 2.

  - Mean time between failures: 4.

  - Service follow-up after fix: 5.

  - Total customer satisfaction: 5.

  - On-schedule performance of PM: 3.

  - Applications support: 5.

- The subject reports that if a Computervision user has less than 95% uptime, the vendor pays a penalty to the customer. Users report that this is indeed the case but that the amount of the penalty in no way adequately compensates the amount lost due to production loss.

14. THIRD-PARTY MAINTENANCE

- The respondent reports that the vendor is not at present using any third-party maintenance organization. The use of third-party maintenance would be considered in very remote areas.

- The respondent states that Computervision would very much like to have its customers diagnose faults in the equipment. It is the vendor's plan to do more in this area in the future, but very little is being done at present.

15. MAINTENANCE AS PROFIT/LOSS CENTER

- The subject did not wish to answer this question. He states that the most important objective to be considered is customer satisfaction.

- While no estimate was given for 1980 profit/loss, the respondent states that profit is not a problem. His comments were: "Two years ago we had less than half of the users on a service contract but now have more than 90% on contract. We charge them more than our competitors but we provide the best service. Users will pay more for good service."

16. CHANGING MAINTENANCE TECHNIQUES

- In response to the question as to what changes in maintenance techniques are foreseen as a result of rising labor costs and increasing product/price performance, the subject's responses were:
  - 1980: "Rising labor costs must be offset by changes in performance."
  - 1982: "Ninety-eight to ninety-nine percent uptime will be required."
  - 1985: "More redundancy will allow a better queuing of field service force."
- Subject has no comment on whether changes in maintenance techniques will emanate from any other source (government, technology, etc.).

17. MOST IMPORTANT IMPROVEMENTS A VENDOR COULD CURRENTLY PROVIDE

- Respondent sees the most important improvements which a vendor could provide to the user as:
  - Reliability and maintenance of peripherals.
    - Disks (use only hard disks).
    - Tape.
    - Input/output devices.

C. ANALYSIS OF RESULTS FOR APPLICON, INC.

1. INTERVIEWEE PROFILE

- The subject interviewed was the National Operations Manager for Applicon. He reports to the Director of Field Engineering.

2. NUMBER OF MAINTENANCE DEPOTS

- The subject would not respond to this question.

3. NUMBER OF FIELD ENGINEERING LOCATIONS

- The respondent states that there are 39 field engineering locations.

4. MAINTENANCE PERSONNEL

- The maintenance function of Applicon is reported to have a total of 127 personnel distributed as follows:
  - Field engineers: 90.
  - Field management: 11.
  - Administrative: 26.

5. SYSTEM SUPPORT CENTERS

- The respondent chose not to respond to this question.

6. VENDOR'S RATING OF SERVICE PERSONNEL RELATIVE TO COMPETITORS

- On a scale from one to five (with five indicating excellent and one indicating poor), the subject rated his own maintenance staff on the following characteristics.

    - Attitude: 5 (staying the same).
    - Proficiency: 4 (getting better).
    - Appearance: 4 (staying the same).
    - Female servicepersons: 5 (staying the same).
    - Verbal communications: 4 (getting better).
    - Written communication: 4 (staying the same).

- The respondent's rating of the service personnel of the competitors on the same characteristics was:

    - Attitude: 3.
    - Proficiency: 4.
    - Appearance: 3.
    - Female servicepersons: no response.
    - Verbal communication: no response.
    - Written communication: no response.

7. FIELD ENGINEERING TRAINING PROGRAM

- The subject limits his comment to stating that Applicon does have a formal training program for field engineers for both hardware and software.

8. PERSONNEL TURNOVER

- Respondent declines to answer.

9. FIELD ENGINEERING INCENTIVE PROGRAMS

- The subject reports that Applicon does not have an incentive plan for field engineering personnel.

10. PERCENTAGE OF TIME INSTALLING ENGINEERING CHANGE NOTICES

- The respondent states that during 1979, 2% of the total engineering person hours was spent in installing ECNs. He states that no amount of time was spent for software.

11. VENDOR'S PERCEPTION OF THE IMPORTANCE OF FIELD MAINTENANCE CHARACTERISTICS TO USERS

- On a one-to-five scale of importance (with one indicating lowest importance and five indicating highest importance), the respondent rated the following characteristics as to their relative importance to Applicon users.
  - Mean time to respond: 5.
  - Mean time to repair: 5.
  - Performance of PM: 4.
  - Keeping maintenance expense below annual 15% increase: 3.

- The respondent states performance targets for the following field maintenance characteristics.

  - Mean time to respond: 4 hours.

  - Mean time to repair: 2 hours.

- As shown in Exhibit IV-2, the vendor's rating of the maintenance characteristics is a good approximation of the importance ratings provided by the respondent users of Applicon systems.

12. ACTUAL PERFORMANCE LEVELS AS REPORTED BY VENDOR

- The respondent states the following performance levels as representative of the service being received by Applicon users.

  - Uptime: 95%.

  - Mean time between failures: doesn't know.

  - Mean time to repair: 3.8 hours.

  - Mean time to respond: 4.4 hours.

- Actual performance levels reported by respondent users:

  - Uptime: 95%.

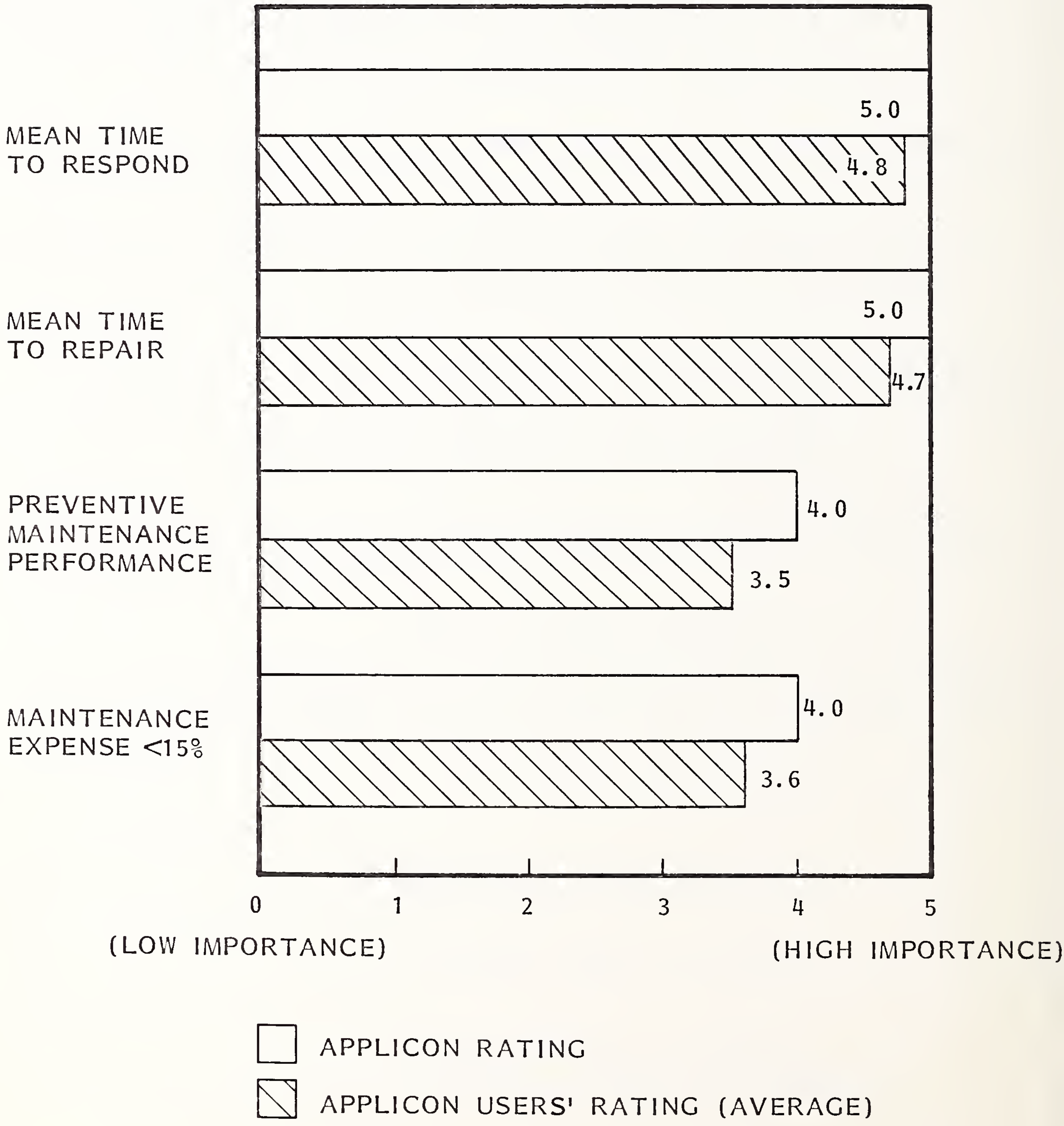
  - Mean time between failures: no data.

  - Mean time to repair: 23.8 hours.

  - Mean time to respond: 18.2 hours.

EXHIBIT IV-2

COMPARISON OF APPLICON AND APPLICON USERS' RATINGS OF THE IMPORTANCE OF FIELD MAINTENANCE CHARACTERISTICS



13. QUALITATIVE EVALUATION OF MAINTENANCE OPERATION

- On a one-to-five scale (with one indicating poor and five indicating excellent), the respondent rated Applicon's maintenance operation as follows:
  - Personnel turnover: 5.
  - Mean time to respond: 3.
  - Mean time to repair: 3.
  - Mean time between failures: 3.
  - Service follow-up after fix: 4.
  - Total customer satisfaction: 4.
  - On-schedule performance of PM: 3.

14. THIRD-PARTY MAINTENANCE

- The subject states that Applicon does not use third-party maintenance.
- The respondent reports that Applicon would want their customers to diagnose faults in their equipment.

15. MAINTENANCE AS PROFIT/LOSS CENTER

- The subject limits his comments to the statement that the maintenance function is a profit center for Applicon.
- The respondent reports that the estimated profit for 1980 will be $1.5 million.

16. CHANGING MAINTENANCE TECHNIQUES

- In response to the question concerning what changes in maintenance techniques are foreseen as a result of rising labor costs and increasing product/price performance, the subject's responses were:

  - 1980: "Actions to combat decreasing skill level of new hires."

  - 1982: "Utilization of remote diagnostics."

  - 1985: "More customer-performed first and second level maintenance."

- The subject sees changes in techniques emanating from technological advances. Specifically he sees the increase in built-in diagnostic aids and the increased usage of remote diagnostics.

17. MOST IMPORTANT IMPROVEMENTS A VENDOR COULD CURRENTLY PROVIDE

- Subject identifies built-in diagnostic aids as most important.

D. ANALYSIS OF RESULTS FOR M&S COMPUTING

1. INTERVIEWEE PROFILE

- The individual interviewed was the Eastern Operations Manager for M&S. He reports to the Field Service Manager who in turn reports to the Manager of Operations. By the year 1982, field service will become a division of M&S.

2. NUMBER OF MAINTENANCE DEPOTS

- The respondent reports that M&S has five regional maintenance depots which are tied in with the regional offices.

3. NUMBER OF FIELD ENGINEERING LOCATIONS

- The subject reports that M&S has 32 field engineering locations.

4. MAINTENANCE PERSONNEL

- The respondent does not report a total for the number of personnel within the field maintenance organization, but does indicate that there are a total of 50 field engineers throughout the five regions.

5. SYSTEMS SUPPORT CENTERS

- The subject states that at present, M&S does not have any systems support centers. He is unaware of the future plans but would like to have some systems support capability in the near future.

6. VENDOR'S RATING OF SERVICE PERSONNEL RELATIVE TO COMPETITORS

- On a scale from one to five (with five indicating excellent and one indicating poor), the subject rated his own maintenance staff on the following characteristics.

  - Attitude: 4 (getting better).
  - Proficiency: 3 (getting worse, not required to know as much as before).
  - Appearance: 4.
  - Female salespersons: no response (has only one).
  - Verbal communication: 5 (staying the same; an essential quality).
  - Written communication: 3 (getting better; becoming more important).

- The respondent's rating of the service personnel of the competitors on the same characteristics was:
    - Attitude: 4.
    - Proficiency: 3.
    - Appearance: 4.
    - Female servicepersons: no response.
    - Verbal communications: 5.
    - Written communications: 3.
- The comparison of the two ratings shows that the respondent sees his own maintenance staff as being no better or no worse than the competition.

7. FIELD ENGINEERING TRAINING PROGRAM

- The subject limits his response to stating that M&S has a formal training program for field engineers for both hardware and software.

8. PERSONNEL TURNOVER

- The subject reports the following changes in personnel for 1979:
    - Total new hires: 30.
    - Total separations: 4.
    - Year end head count: 32.

9. FIELD ENGINEERING INCENTIVE PROGRAMS

- The respondent reports that M&S does not have an incentive plan in place for field service personnel and has no plans to do so in the future.

10. PERCENTAGE OF TIME INSTALLING ENGINEERING CHANGE NOTICES

- The subject does not report a number for the amount of time spent installing EGNs but reports the amount of time as being low; not over 2-3%. He states that in most cases, they send the user the new card and the user swaps the cards on-site.

11. VENDOR'S PERCEPTION OF THE IMPORTANCE OF FIELD MAINTENANCE CHARACTERISTICS TO USERS

- On a one-to-five scale of importance (with one indicating lowest importance and five indicating highest importance), the respondent rated the following field maintenance characteristics as to their relative importance to M&S users:

    - Mean time to respond: 5.
    - Mean time to repair: 4.
    - Performance of PM: 2.
    - Keeping maintenance expense below annual 15% increase: 3.

- The respondent reports that M&S does not have performance targets at the present time but is in the process of developing them.

12. ACTUAL PERFORMANCE LEVELS AS REPORTED BY VENDOR

- The respondent states the following performance levels as being representative of the services being received by M&S users:

  - Uptime: 95%.

  - Mean time between failures: 1 month.

  - Mean time to repair: 8 hours.

  - Mean time to respond: 3-4 hours (states that M&S has a lower person/machine ratio than competitors)

13. QUALITATIVE EVALUATION OF MAINTENANCE OPERATION

- On a scale of one to five (with one indicating poor and five indicating excellent), the respondent rated M&S's maintenance operation as follows:

  - Personnel turnover: 4.

  - Mean time to respond: 2-3 (cites parts problem).

  - Mean time to repair: 2-3 (cites parts problem).

  - Mean time between failure: no response.

  - Service follow-up after fix: no rating. ("We are in close communication with user but no formal procedure.")

  - Total customer satisfaction: 3 (gotten much better last six months).

  - On-schedule performance of PM: 2-3.

- The subject states that he feels the rating of the competition on mean time to respond, mean time to repair, and PM would be about the same. He indicates that parts are a problem for all vendors.

14. THIRD-PARTY MAINTENANCE

- The respondent states that M&S does not now use third-party maintenance and would not consider it in the future due to the possibility of losing trade secrets.

- The respondent reports that he would like users to assist in isolation of problems on an occasional basis.

15. MAINTENANCE AS A PROFIT/LOSS CENTER

- The subject reports that he does not consider the maintenance as either a profit generator or a cost center. He considers it a maintenance center. He does state that maintenance will probably be a profit maker in "about a year or so."

- The respondent would not estimate the profit/loss for 1980 beyond the statement that it would be profitable in metropolitan areas and a loss in remote areas.

16. CHANGING MAINTENANCE TECHNIQUES

- In response to the question as to what changes in maintenance techniques are foreseen as a result of rising labor costs and increasing product/price performance, the subject responses were:

  - 1980: no comment.

  - 1982: "Are looking to faster response and repair."

- 1985: "We would lower labor costs but that is not the prime reason."

- The respondent sees the vendor's techniques as being governed by changes in technology (i.e., micros in everything).

17. MOST IMPORTANT IMPROVEMENTS A VENDOR COULD CURRENTLY PROVIDE

- The respondent reports the most important improvement a vendor could presently provide would be the increase in the number of spare parts depots. He states that isolating the problem is done fairly rapidly but that they always have to wait for parts. An additional comment:

  - "When a board costs $8 thousand, you don't want too many of them out there."

APPENDIX A: PROFILE OF USERS AND VENDORS INTERVIEWED

APPENDIX A: PROFILE OF USERS AND VENDORS INTERVIEWED

- Calma Users Surveyed:
  - Delco Electronics
    Goleta, CA
  - Atari
    Sunnyvale, CA
  - National Security Agency
    Meade, MD
  - Honeywell Inc.
    Billerica, MA
  - MOS Technology
    Norristown, PA
  - Sprague Electric
    Worcester, MA
  - AUGAT Inc.
    Attleboro, MA
  - Fairchild Semiconductor
    San Jose, CA
  - State of Oregon Department of Revenue
    Salem, OR
  - Proctor and Gamble
    Cincinnatti, OH
  - Collins Radio Co.
    Newport Beach, CA

- Auto-Trol Users Surveyed
  - Butler Manufacturing Co.
    Kansas City, MO
  - General Motors Electromotive Division
    La Grange, IL
  - Panhandle Eastern Pipeline
    Kansas City, MO
  - Combustion Engineering
    Bloomfield, NJ
  - Black and Veatch
    Kansas City, MO
  - Fruehauf Corporation
    Detroit, MI
  - Exxon America
    Bayway, NJ
  - Stearns-Rogers Inc.
    Denver, CO
  - Clark Equipment Co.
    Benton Harbor, MI
  - Herman Miller Manufacturing
    Zeeland, MI
- Applicon Users Surveyed:
  - CTS of Berne
    Berne, IN
  - General Motors; Corp. Manufacturing and Development
    Warren, MI
  - MAPCO Inc.
    Tulsa, OK
  - Cincinnatti Milacron
    Cincinnatti, OH
  - Delco Morain
    Dayton, OH

Tulsa, OK

- Structural Dynamics Research Corporation
  Milford, OH

- Warren Gear Co.
  Muncie, IN

- CE NATCO
  Tulsa, OK

- Computervision Users Surveyed

  - Lawrence Livermore Laboratories
    Livermore, CA

  - Bertea, Corp.
    Irvine, CA

  - Southern California Edison
    Long Beach, CA

  - FMC Corporation
    Colmar, PA

  - Hewlett-Packard
    Cupertino, CA

  - General Dynamics
    San Diego, CA

  - Air Research Manufacturing
    Torrance, CA

  - Interstate Electronics
    Anaheim, CA

  - McDonald Douglas Corp.
    Monrovia, CA

  - Solar Turbine International
    San Diego, CA

- Vendors Surveyed:

  - Computervision Corporation

  - Applicon Inc.

  - M&S Computing

APPENDIX B: QUESTIONNAIRES

CATALOG NO. YCBD☐☐☐

FIELD SERVICE FOR CAD SYSTEMS

User Questionnaire

- The primary objective of this study is to determine the quality of field service capabilities of specific CAD/CAM system vendors as perceived by their users, and what improvements are desired.

1. Are you currently using one of the following CAD systems?

(If "No," terminate. If "Yes," determine quantity and model of units installed.)

	Quantity Installed	Model(s)
a) Applicon		
b) Auto-Trol		
c) Calma		
d) Computervision		

2. What application(s) are performed?

a) CAD ☐

b) CAM ☐

c) Describe:

INPUT

3. Rate the importance to you of the following field maintenance characteristics: (5 = highest, 1 = lowest)

Factor	Rating	Rank 5s
a) Mean Time to Respond (in-person arrival of service person measured in hours after call is placed)		
b) Mean Time to Repair (of equipment, after service person arrives on site)		
c) Performance of Preventive Maintenance		
d) Keeping Maintenance Expenses to an Average Annual Increase of 15% or Less		
e) Other		

INPU

CATALOG NO. Y C B D ☐ ☐ ☐

4. For your CAD/CAM equipment installed:

a) What is the minimum acceptable performance?

b) What are you currently receiving?

Note: If familiar with more than one vendor, complete for more than one.

Equipment Manufacturer		Percentage Uptime (%)	Mean Time Between Failure (hours)	Mean Time to Respond (from user call to service person's appearance) (hours)	Mean Time to Repair (after service person arrives) (hours)
Applicon	a)				
	b)				
Auto-Trol	a)				
	b)				
Calma	a)				
	b)				
Computervision	a)				
	b)				

INPUT

4. c. Comments regarding comparisons (if any) between vendors:

____

____

____

____

d. Does your vendor follow up with you after a fix is completed?

☐ Yes ☐ No

How important is this to you? (comments)

____

____

e. How important to you is an unscheduled call to check on your software performance? (1 = unnecessary, 5 = very desirable)

____

5. How much extra (%) would you spend for an improvement in mean time to respond (X) and mean time to repair (Y); and what would that "ideal service" be in terms of X and Y?

Product	Mean Time to Respond (X) Repair (Y) (hours)	Absorb Extra Cost (%)
a) Applicon	/	
b) Auto-Trol	/	
c) Calma	/	
d) Computervision	/	

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CATALOG NO. Y C B D ☐ ☐ ☐

6. If you have multiple vendors' equipment installed (mainframes and peripherals), whose is down the most?

a) Vendor Name ____________________

b) Type ____________________

c) Maintenance Vendor ____________________

Whose is down the least?

d) Vendor Name ____________________

e) Type ____________________

f) Maintenance Vendor ____________________

7. Have you replaced or are you in the process of replacing any equipment because of poor maintenance?

a) Yes ☐

b) No ☐

c) If "Yes":

  1) Vendor Name ____________________

  2) Type ____________________

  3) Maintenance Vendor ____________________

  4) Reason: ____________________

  ____

d) The availability (uptime) of the new equipment is:

  1) Better ☐

  2) About the Same ☐

  3) Worse ☐

  4) Not Yet Installed ☐

INPUT

CATALOG NO. Y C B D ☐ ☐ ☐

8. With regard to your current vendor and other vendors, how do you rate the equipment and maintenance? (5 = excellent, 1 = poor)

Vendor(s)	Equipment Rating	Maintenance Rating	Comments

9. a) List any vendors whose equipment you would refuse to consider in the future due to past maintenance problems:

____

____

____

____

b) Describe past maintenance problems?

____

____

____

____

INPU

10. Of the companies (manufacturer or third-party) performing maintenance on your equipment, rate them overall and on the basis of their performing preventive maintenance (PM). (5 = very effective, 1 = very poor)

Company	Overall Rating	PM Performed (check)		Rating (relative to the on-schedule performance of PM)
		On Shift	Off Shift	
a)				
b)				
c)				
d)				

e) Comments:

CATALOG NO. Y C B D ☐ ☐ ☐

11. What is your perception as a user of the maintenance people servicing you concerning the following factors? (rate on a scale of 1-5, 1 = poor, 5 = excellent)

Factor	Prime Vendor Rating	Vendor Rating (if more than one vendor)	Getting Better Staying the Same Getting Worse
a) Attitude			/
b) Proficiency			/
c) Appearance; i.e., shirt and tie (for male)			/
d) If you have female service persons, how do they compare			/
e) Ability to communicate verbally			/
f) Ability to communicate in writing			/
g) Other			/
h) Other			/
i) Other			/

CATALOG NO. Y C B D ☐ ☐ ☐

12. Rate your degree of satisfaction with software support offered by your vendor(s). (rank vendors, if applicable as: 1 = lowest, 5 = highest.)

Vendor	Rating	Ranking	Comments
a) Applicon			
b) Auto-Trol			
c) Calma			
d) Computervision			

e) Comment on software reliability; i.e., number of "crashes":

____

____

____

____

f) Comment on software quality; i.e., state-of-the-art cleanliness:

____

____

____

____

12. g) Comment on the adequacy of software documentation supplied by the vendor:

____

____

____

____

13. a) Have you checked other vendors' software?

☐ Yes ☐ No

b) Comments:

____

____

____

____

14. Rank the vendor(s) concerning the user training quality provided. (1 = lowest, 5 = highest)

Vendor	Rating	Ranking	Comments (ref: hardware or software)
a) Applicon			
b) Auto-Trol			
c) Calma			
d) Computervision			

INPU

14. e) How long does initial operation training last?

_________ Days

f) Do you feel adequately trained to use the software?

☐ Yes ☐ No

g) What should be done to improve training?

____

____

____

____

15. a) How long should your vendor(s) require to fix a major software bug?

____

____

____

____

b) How long does it take?

____

____

____

____

c) In what format does a "fix" for a software release come to you? (e.g., tape dump (partial or complete), other documentation, etc.)

____

____

d) In what format would you prefer?

____

____

16. a) How many software enhancements does your vendor(s) release per year?

______

b) Describe his responsiveness towards your suggestions: (1 = unresponsive, 5 = incredibly responsive)

______

c) Comments on "b":

______

______

______

______

17. a) On balance, is your vendor delivering the level of hardware and software maintenance committed to at the time you purchased the equipment?

☐ Yes ☐ No

Explain: ______

______

______

______

b) How responsive is your vendor in answering simple hardware or software problem questions? (1 = non-responsive, 5 = very responsive)

______

18. What is the most important improvement(s) a CAD/CAM vendor can provide in maintenance or service?

a) Hardware

b) Software

______

______

______

______

19. Would you, as a user, consider the following:

	Yes or No	Comments
a) Install equipment yourself		
b) Cooperative testing by running diagnostics before calling vendor for maintenance help		
c) Actually performing maintenance on your product or system		
d) Deliver equipment to vendor maintenance depot for repair or replacement		

e) Are you presently doing a, b, c, or d?

☐ Yes ☐ No

Describe: ____________________

____

____

____

____

____

THANK YOU VERY MUCH!

CATALOG NO. Y C B D ☐ ☐ ☐

FIELD SERVICE FOR CAD SYSTEMS

Vendor Questionnaire

1. a) What is the title of the senior corporate maintenance executive?

____

b) To whom does this person presently report?

____

c) To whom do you think this person will report in 1981-1982?

____

d) What functions report to this person?

____

____

____

____

2. How many maintenance depots do you have, and where are they located?

____

____

____

____

3. How many field engineering locations do you have?

____

4. Number of employees in your maintenance organization:

a) Total headcount __________ (a = b +c + d)

b) Field engineer count __________

c) Field management count __________

d) Administrative count __________

5. a) Do you have systems support centers?

☐ Yes ☐ No

If "Yes," how many? ____________________

b) What are your plans regarding systems support centers?

____

____

____

____

____

____

6. What is your perception of the image created by your maintenance people compared to your competition concerning the following factors? (rate on a scale of 1-5, 1 = poor, 5 = excellent)

Factor	Your Own People	Your Competition's	Getting Better Staying the Same Getting Worse
d) Attitude			/
b) Proficiency			/
c) Appearance; i.e., shirt and tie (for male)			/
d) If you have female service persons, how do they compare			/
e) Ability to communicate verbally			/
f) Ability to communicate in writing			/
g) Other			/
h) Other			/
i) Other			/

CATALOG NO. Y C B D ☐ ☐ ☐

7. a) Do you have a formal training program for field engineers for:

1) Hardware ☐ Yes ☐ No

2) Software ☐ Yes ☐ No

b) If "No," why not?

1) Hardware

____

____

____

____

2) Software

____

____

____

____

8. a) Total new hires (field engineers) in 1979: ________

b) Total separations (field engineers) in 1979: ________

c) Year end head count in 1979: ________

9. a) Do you have an incentive program for field engineers?

☐ Yes ☐ No

b) Describe: ____________________

____

____

____

10. What percentage of total field engineering person hours was spent in installing ECN's (Engineering Change Notices) during 1979?

______%

a) Software: ______%

b) Hardware: ______%

11. As you perceive it, rate (5 = highest, 1 = lowest) the importance to your customer of the following field maintenance characteristics (i.e., how important are the following field maintenance characteristics to your customer?). Also, please give your performance targets for a) and b).

Factor	Rating	Rank 5s	Performance Targets (hours)
a) Mean Time to Respond (in person)			
b) Mean Time to Repair (of equipment)			
c) Performance of Preventive Maintenance			
d) Keeping Maintenance Expense Increases to Under 15% Per Year			
e) Other			
f) Other			

12. What is the average estimated time that you actually provide to your customers?

Percentage Uptime (Percent)	Mean Time Between Failure (Hours)	Mean Time to Repair (Hours)	Mean Time to Respond (Hours)

13. In your opinion, rate your maintenance operation in relation to competition for the following factors: (5 = excellent, 1 = poor)

Factor	Rating	Rank 5s
a) Personnel turnover		
b) Mean time (MT) to respond		
c) Mean time (MT) to repair		
d) Mean time (MT) between product failure		
e) Service follow-up after a fix is completed		
f) Total customer satisfaction		
g) On schedule preventive maintenance		
h) Other		

14. a) Do you presently use a third-party maintenance organization for maintaining any of the products your company markets?

☐ Yes ☐ No

b) If "No," under what conditions would you consider it?

____

____

____

____

c) Would you want your customer to diagnose faults in his equipment?

☐ Yes ☐ No

15. Do you consider (in your company) maintenance as a:

a) Profit generator ☐

b) Cost center ☐

c) Comments: (interviewee comments especially important here)

____

____

____

____

____

____

d) What do you estimate is the 1980 maintenance profit/loss?

Profit $ ______________

Loss $ ______________

CATALOG NO. Y C B D ☐ ☐ ☐

16. What changes in maintenance techniques do you foresee as a result of rising labor costs and increasing product/price performance?

a) 1980: ______________________________

b) 1982: ______________________________

c) 1985: ______________________________

d) Do you see changes in maintenance techniques from any other source? (government, technology, etc.)

☐ Yes ☐ No

Comments: ______________________________

CATALOG NO. YCBD

17. What do you believe would do the most to improve the services currently provided to your user?

THANK YOU VERY MUCH!

APPENDIX C: USERS' COMMENTS

APPENDIX C: USERS' COMMENTS

A. POSITIVE COMMENTS: AUTO-TROL

- "Maintenance proficiency is a mater of tenure; the longer they're on the job the better they get."
- "The operator's manual is good."
- "They do a good job in training."
- "The software documentation has improved a great deal over the last year."
- "There was a giant leap in software quality with the GS-2000 release."
- "Good basic training!"
- "Satisfied with graphics software support."
- "For pure graphics, Auto-Trol is the best."
- "The present serviceman is excellent."
- "My man makes unscheduled service calls to check on my system and I really appreciate it."

- "In general the older software is reliable."
- "Auto-Trol is the best for my application."

B. NEGATIVE COMMENTS: AUTO-TROL

- "Going to nonturnkey for expansion of application."
- "They've never met a PM schedule yet. There have been problems after a PM which were the direct result of them performing the PM."
- "Auto-Trol diagnostics are too complex to be run by anyone but a serviceman."
- "There is a terrible lack of software documentation."
- "We've experienced rather severe problems implementing an upgrade."
- "Inexperienced instructor spent too much time on theory."
- "Spreading themselves too thin personnel-wise. The responses to questions are slow coming in."
- "I'm not even sure what the PM schedule is or if Auto-Trol even has one. All I know is that they are erratic in performing PM.
- "Their documentation is not clear and certainly not on a level with IBM, CDC or DEC."
- "Let's say our expectations have not been met in terms of software support."
- "They're responsive in answering simple hardware and software questions but are getting less so as the company grows."

- "Have had a history of problems with small bugs that they seem to give a very low priority."
- "They do not follow up on the enhancements with good documentation."
- "FEs are fantastic but they can't do anything without parts."
- "They don't have instructors who know our application."
- "They are a little lax in meeting PM schedules."
- "They're 95% late on software upgrades. The upgrades create as many or more problems than they fix."
- "There is a lack of quality control in the spare parts."
- "They said we could convert our Mark IV plotter to a vacuum top with no problem. After purchase we find there's a three to four month delay and a cost of $12,000."

C. POSITIVE COMMENTS: CALMA

- "Once the software is working, it's excellent."
- "As far as new software, they're ahead of the other companies."
- "Once you get the software running it works."
- "Have not had a major failure in a year."
- "Good equipment!"

- "Software reliability is very good."
- "Very good documentation."
- "We checked out the software from CVN and APP and for our needs Calma is the best."
- "Software seems very reliable."
- "We are now looking at a GSII."
- "The software is reliable."
- "Our present serviceman is excellent."
- "We did a lot of research prior to selecting Calma."
- "I've heard some good things about GDSII."

D. NEGATIVE COMMENTS: CALMA

- "Since the takeover by United Telecommunications, Calma seems to be becoming more remote from end users."
- "I don't think the documentation is proofread and the typos will drive you crazy."
- "Our hardware and software expectations have not been met."
- "Trainers were somewhat less than enthusiastic."

- "We encountered a bug in November that is yet to be fixed. Supposedly the fix was sent in late April but we haven't seen it.

- "They are constantly changing personnel and as a result we've never had any PM work done. We've been called to say we're getting one but that's the last we ever hear about it."

- "Seems the new software is not as good as the old."

- "We're thinking of training our own serviceman due to the cost of the contract."

- "Calma is soft on meeting schedules for custom packages."

- "Would refuse to use Calma in the future as the result of our past experience with maintenance."

- "Poor response time, poor service in general, and failure to deliver the type of system contracted for."

- "The older maintenance was good; as the company grew, it got worse. They had to train new people who were not as concerned as the people who started the company."

- "I feel Calma service is extremely poor: long response time, partial software delivery, no PM and poor training."

- "Have not had one serviceman who is pro-Calma."

- "They're getting big so fast and not expanding their maintenance force."

- "Low-quality manuals are difficult to read and understand."

- "We had a module that wouldn't work - it took over six months to fix. This is not including the fact that they've sold us software they can't deliver."

- "Since the new repairman started in April, they have seen no PM. I never see the new repairman."

- "They promised us a 24-hour turnaround and haven't met it yet. They also said if a major problem wasn't fixed in 48 hours they would replace the whole unit - I haven't seen any of this action either."

E. POSITIVE COMMENTS: COMPUTERVISION

- "Very happy with Computervision and especially with their serviceman."

- "On a scale of one to five, I'd rate Computervision a five as compared to other systems."

- "Our repairman is very dedicated; he's super."

- "Computervision is continually improving their software. It is much better now than when we received the system one and one-half years ago."

- "They do a pretty good job on PM."

- "We have a real good serviceman right now."

- "The older software is as solid as concrete."

- "If you consider the growing pains the company has been through and not get selfish, their maintenance has improved over where it has been."

- "I think Computervision's software is better than the competitors'."

- "We benchmarked three different systems before purchasing Computervision's."

- "Our new serviceman is excellent. The '5' rating applies to him alone."

- "The software is pretty reliable. There is a break in period but that's to be expected."

- "The software documentation they provide is very good. They send us a lot, more than most people see."

F. NEGATIVE COMMENTS: COMPUTERVISION

- "We're hurting for documentation. It's not complete."

- "Less than adequate instructors."

- "They're growing too fast and their response time for software problems reflects this."

- "They will not set a PM schedule despite the fact that our contract calls for it."

- "Some of their maintenance people are inexperienced."

- "I understand there was a big problem with CADDS III Revision 10 and its derivatives."

- "We had bugs that were important to us but not them. Their response reflected their evaluation and not ours."

- "Software documentation is very inadequate and most of the time completely non-existent."

- "There is no one available on the west coast to answer simple software questions."

- "PM should be between 90 days and 6 months. They schedule them and never meet the schedules. Also it's hard to get them to schedule them in the first place."

- "We have too many crashes. Recently I have been unable to predict production because of software problems and terminal 'hangs.' "

- "I've been asking for a PM schedule for over three months and it's always 'tomorrow'. I think we were due a PM a month ago."

- "We are not completely happy with the hardware. The machine horsepower isn't up to par."

- "Their training gave us just enough to be dangerous. The beginning class needs to be twice as long."

G. POSITIVE COMMENTS: APPLICON

- "I like their approach to the overall graphics system and the logic of their commands."

- "They have good service people - they are spread thin but the total effort is good. They are very cooperative."

- "We are getting ideal service now."

- "Their knowledge of our application has been improving."

- "In general, the quality of their software is very good."

- "Each vendor has its good points in software but not enough in any one system to make us want to switch from Applicon."

- "We're a source site so they give us good documentation."

H. NEGATIVE COMMENTS: APPLICON

- "The service isn't acceptable now."

- "We are having a problem with the plotter that is unresolved as of yet. We would like a speedier response."

- "Last Friday we looked at Computervision. Applicon better get on the ball in piping because Auto-Trol and Computervision are walking away with it."

- "They drag their feet on meeting PM schedules."

- "I'd buy more software from them if I could get someone out here as I've requested."

- "Getting software support is practically impossible. I think they are growing too fast."

- "We have a custom software piece that has never worked right. There are always different people to talk to and you have to start from scratch."

- "They're expanding so quickly they've kind of lost control of their software function."

- "Pretty soft on meeting PM schedules."

- "Training is generally lousy."

- "The software is not as reliable as it was sold to be."

- "They do PM on a random schedule."

- "I had a burned out power supply in a terminal. Applicon said to call in Tektronix but they wouldn't work on OEM equipment unless Applicon was also called. So I ended up paying T&M rates for both calls."

- "We are looking for a new system. We are checking CVN, AUT, and M&S. We will replace the Applicon system as soon as we find a suitable replacement."